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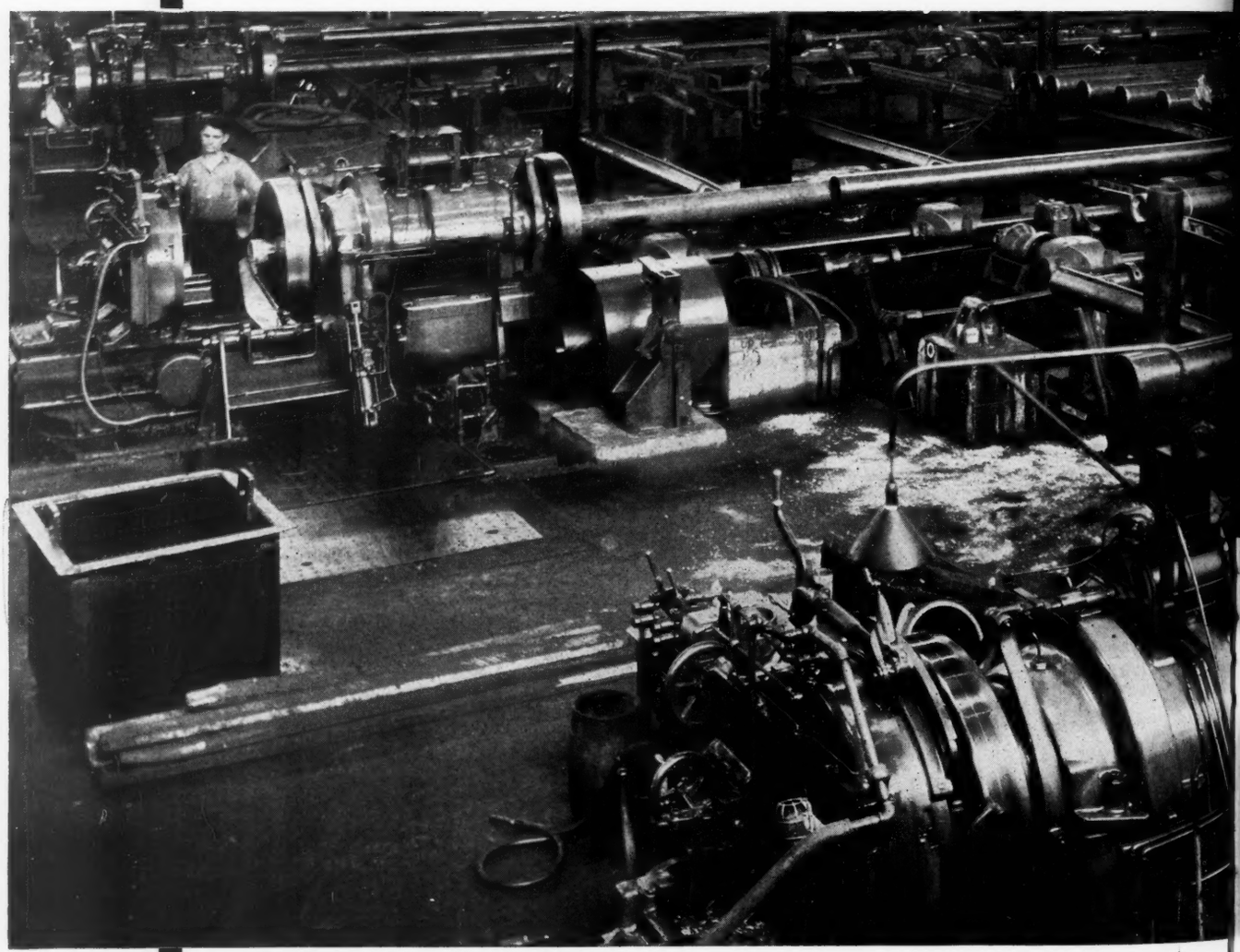

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Forging Aluminum and Magnesium

By G. D. WELTY
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Aluminum Company of America

FORGING is a relatively new method of shaping the light alloys aluminum and magnesium. The use of this hot-working method expanded tremendously during World War II because of the great demands made upon it by the aircraft industry. While only about 1 per cent of the aluminum produced in this country before the war went into forgings, approximately 15 per cent was used in this way at the close of the war.

About 35 per cent of the total weight of military air-cooled aircraft engines consists of aluminum-alloy forgings. Forgings of aluminum alloys also serve a most important function as

highly stressed structural fittings and other parts of airframes. Aluminum- or magnesium-alloy forgings have the same general advantages over castings as forgings of any other metal compared with corresponding cast shapes. Physical properties are substantially greater than those of cast alloys, and, in addition, the forgings possess a high degree of homogeneity or structural uniformity.

Light alloy forging stock—up to 8 inches in diameter—is rolled or extruded. Most aluminum forging alloys are rolled because of the greater rolling capacity at the source of supply. Magnesium alloys, on the other hand, are generally extruded because they are difficult to roll. Both rolled and extruded forging stock may be supplied either in the cold-finished form, to obtain closer tolerances and better surface finish, or in the hot-finished state, depending upon the requirements. Forging stock larger than 8 inches in diameter is drawn to the desired size on presses from ingots that are approximately 20 inches square.

Careful inspection of forging stock is essential. Seams or other surface defects cannot be tolerated because such defects will persist during forging, and will be present in the finished part unless they are removed by grinding, chipping, or milling. Chemical analysis and metallurgical inspection of the ingots and rolled or extruded stock are performed at the supply source. When received in the forging shop, the stock is given a careful visual inspection and all surface imperfections are removed.

Forging stock more than 8 inches in diameter or 6 inches square is inspected for internal defects by means of the Sperry supersonic "Reflectoscope" seen in Fig. 1. This non-destructive method of inspection sends waves of supersonic vibration into the forging stock and measures the elapsed time between the transmission of a wave and the return of a reflection. The waves are reflected from the opposite side of the part or from flaws within the part. A cathode-ray oscilloscope measures the time of wave travel, and is calibrated to indicate visually the location of flaws in the part.

Billets or blanks are sheared or sawed from the forging stock, smaller sizes of stock being sheared to the desired length while larger sizes are sawed by means of band, circular, or abrasive cut-off saws. Care must be exercised to produce a smooth surface in this operation, since saw marks will show in the forging. The billet size is closely controlled by weighing to insure that there will be sufficient metal to fill the forging die impression and yet not too much, as this would increase the cost of the forging unnecessarily. Billets are permitted to be from 1/2 to 3 ounces over weight, depending on the part, but never under weight.

Accurate control of the temperature to which the billets are heated is necessary to insure forgeability and to prevent "burning," or heating of the metal above the maximum allowable temperature, which will cause a hot-short condition. Metal in this condition loses its plasticity, and splits or crumbles in the forging die. For-

Fig. 1. Internal flaws in forging stock can be readily detected and located by means of the non-destructive, supersonic inspection equipment illustrated

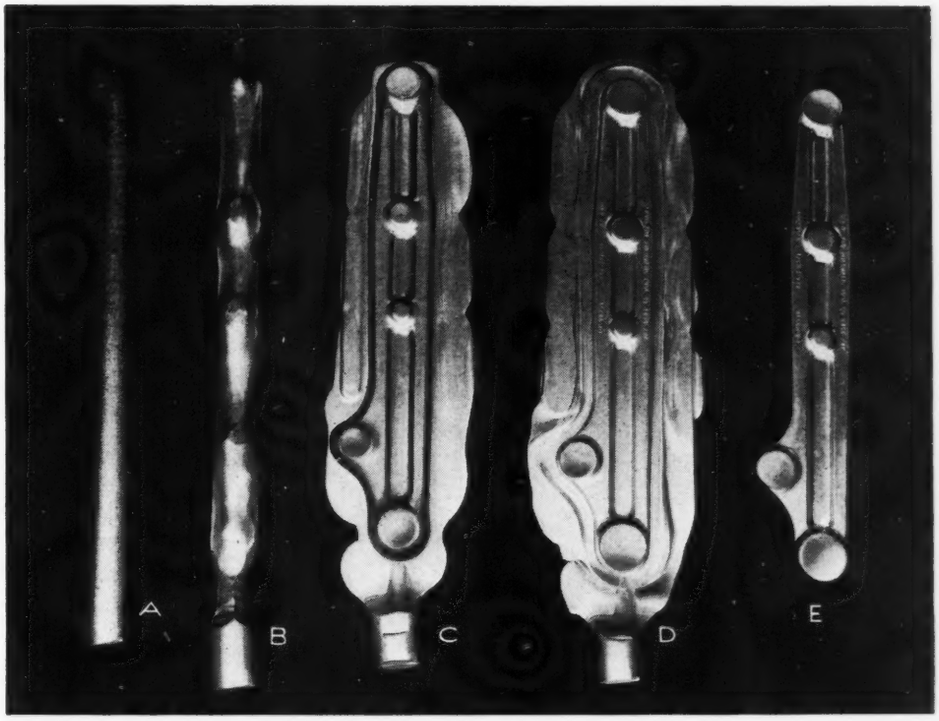


Fig. 2. Progressive steps in the production of a forging for a typical aircraft structural member

ging of light alloys at the lowest temperature possible generally improves the mechanical properties of the part. Furnace temperatures are therefore controlled within ± 10 degrees.

Aluminum forging alloys are generally preheated in the range of from 780 to 860 degrees F., the exact temperature varying with the alloy, design of part, and nature of forging operation. Simple shapes of the more easily forged aluminum alloys, such as A51S, can sometimes be forged cold from annealed stock. Magnesium forging alloys are preheated to a lower temperature, ranging from 700 to 800 degrees F. Magnesium forgings must be removed from the die before they cool below 500 degrees F. to avoid cracking.

When aluminum alloys 18S or A51S are forged on upsetting machines, they are preheated to a temperature of from 880 to 900 degrees F. Gas-fired muffle type furnaces are generally employed for heating the billets. Electrically heated furnaces and induction heating are also satisfactory for this operation.

Forging Techniques Employed on Light Alloys

The number of forging operations necessary to produce a finished shape depends entirely on the design of the forging. Fullering, edging, rolling, and bending operations commonly necessary in forging steel are sometimes eliminated in forging light alloys.

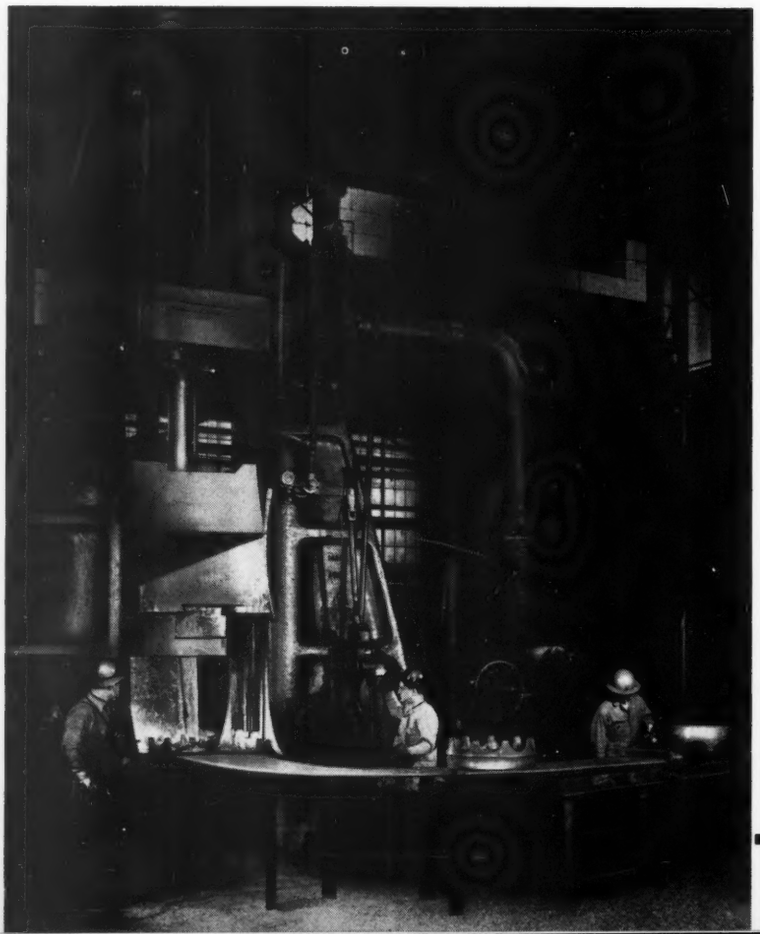
Blocking, or rough-forming the part, is generally the first and most important forging operation on light alloys. The blocked part must be correct, since voids or folds in light alloy forgings will not become "welded" together, and surface defects will not scale off, as is the case in forging steel.

Although one blocking operation is generally sufficient, sometimes two or three are necessary, depending upon the alloy and the shape being forged. Reheating is usually required between blocking operations unless a multiple impression blocking die is employed. Conventional finishing and trimming operations complete the forging. Careful inspection is necessary between operations to detect flaws immediately, so that they can be eliminated by grinding, chipping, or milling before the next operation.

Progressive shapes produced in forging a typical aircraft structural member are shown in Fig. 2. The rolled bar stock of aluminum alloy is seen at *A*, and the edger impression at *B*. The shape shown at *C* is produced by a blocking operation, while the finished forging with flash is seen at *D*. The final trimmed part is illustrated at *E*.

Fig. 3. Blocking operation on a small aluminum-alloy airframe forging being performed on steam-operated hammer

Fig. 4. A 35,000-pound steam-operated hammer is used to finish-forge aluminum crankcase sections for radial aircraft engines



Light alloy forgings are produced on board, air, or steam hammers; upsetting machines; and mechanical or hydraulic presses. The specific type of equipment to be used depends on the alloy to be forged, the design of part, tooling costs, and total production required. Small lots of relatively simple shapes can be rapidly produced on board drop-hammers with low tooling costs. For large production of very accurate forgings, mechanical or hydraulic forging presses are generally preferred. Magnesium alloys cannot be formed rapidly, and therefore do not lend themselves to the impact action of hammers. Such alloys are better forged on mechanical or hydraulic presses having a squeezing action. AM65S magnesium alloy, however, can be satisfactorily forged on hammers.

Because of the relatively low temperatures employed in forging light alloys, heavier equipment is required than is used in steel forging. In general, equipment having a capacity 35 per cent greater than that which would normally be employed for a steel forging of comparable size is satisfactory.

Forging equipment employed at the Cleveland Works of the Aluminum Co. of America ranges from 1500-pound air- or board-operated hammers to 35,000-pound steam hammers, and includes 350- to 2500-ton mechanical presses, 1500- and 3000-ton hydraulic presses, and 2- to 8-inch upsetting machines. The diversified alloys and parts required by the aircraft industry make such a wide range of equipment necessary.

A small aluminum-alloy airframe forging is shown being blocked on an 18,000-pound steam hammer in Fig. 3. A more difficult forging is the aluminum-alloy aircraft landing-gear part seen being blocked in the heading illustration. Alu-

minum-alloy crankcase sections for radial aircraft engines are shown being finish-forged in Fig. 4. The inspector, at the right, is checking a completed hot forging with micrometer calipers, while the operator, at the left, applies lubricant to the forging die. These large forgings require the use of a 35,000-pound steam hammer.

Forging Dies Must Have Good Surface Finish

The material employed for light alloy forging dies is essentially the same as that used in steel forging dies. A die steel containing from 1 to 1.5 per cent nickel, 0.50 to 0.80 per cent chromium, 0.25 to 0.35 per cent molybdenum, and 0.50 to 0.60 per cent carbon has been found to be satisfactory.

Conventional die-sinking or duplicating machines are used for machining the forging die cavities. Plaster cavity models of the forged shape are used as masters for the duplicating operation. A good surface finish is imparted to the machined forging die by grinding and polishing. It is of major importance that light alloy forging dies have a highly polished surface, as this prevents the heated metal from "freezing" to the steel die and minimizes the formation of surface defects on the forging. While scale and die surface imperfections in steel forgings can often be removed by blasting, the surface finish of light alloy forgings is dependent upon the surface finish of the die or subsequent grinding of the forging. Polishing marks should be in the same direction as the desired direction of metal flow in the forging.

Forging dies are preheated by means of a gas flame to a temperature of approximately 400 degrees F., or about one-half the temperature of the billet or slug, to pre-

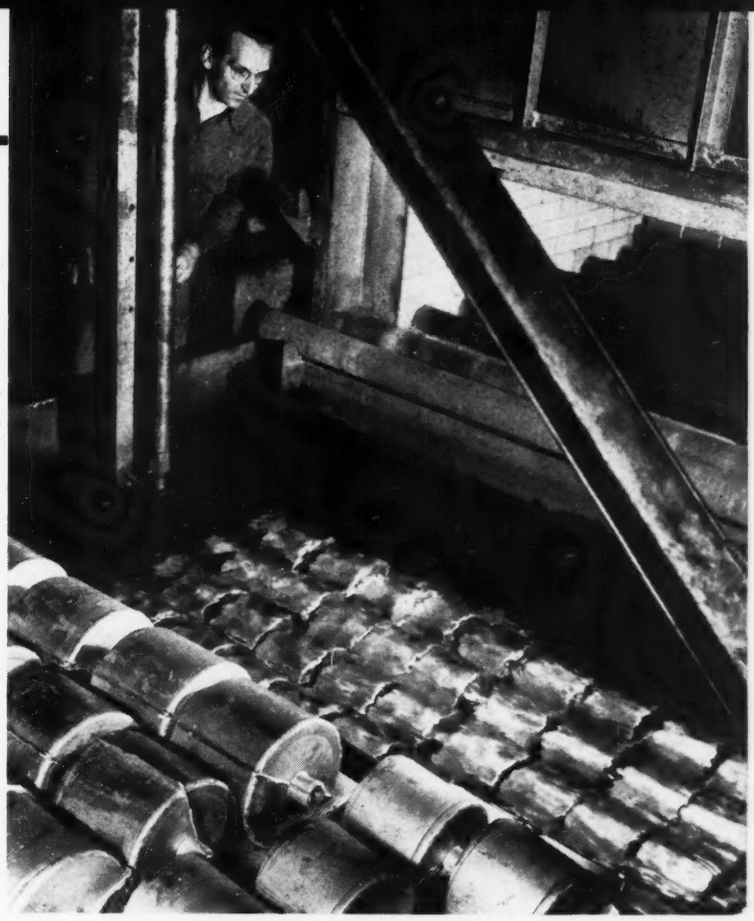


Fig. 5. Quenching of aluminum-alloy forgings from solution heat-treating temperature prevents precipitation of elements in solution

Fig. 6. Light alloy forgings are cleaned to facilitate inspection by dipping them in a caustic solution and rinsing with nitric acid

vent rapid cooling of the work, increase die life, and minimize "freezing" of the forging to the die. In addition to the use of preheated, polished dies, it is also advantageous to employ a good die lubricant. Graphite suspended in a low-viscosity mineral oil and a suitable solvent, and atomized by compressed air, has been found to be a satisfactory lubricant for reducing "freezing" and increasing die life. A straight graphite lubricant, without oil, is preferable for magnesium forging dies. Since graphite is difficult to remove from light alloy forgings, a minimum amount of lubricant should be used.

Heat-Treatment of Aluminum-Alloy Forgings

The mechanical properties of aluminum-alloy forgings can be improved by heat-treatment. The process consists of solution heat-treatment, quenching, and precipitation hardening. In solution heat-treatment, the forgings are rapidly heated to a temperature just below the melting point of any of the alloy constituents. This temperature ranges from 50 to 80 degrees above the forging temperature, or from about 870 to 960 degrees F., depending upon the alloy. The specified furnace temperature must be maintained within ± 10 degrees F. to insure developing the required properties and avoid melting one or more of the lower melting alloy constituents.

Forgings are held or "soaked" at this temperature for a sufficient time, ranging from one-half hour to twelve hours, according to the alloy and forging thickness, type of furnace employed, and size of load, so as to permit the soluble elements of the alloy to go into solid solution. The forgings are then quenched as rapidly as possible (Fig. 5) to prevent or retard immediate precipitation of the elements in solution. Small forgings and those with shapes least subject to distortion are quenched in water that is maintained at a temperature of 85 degrees F. Such a drastic quench is to be preferred if the amount of distortion is not objectionable, since maximum resistance to corrosion and the best mechanical properties are obtained in this way. Larger or more complex forgings must be less severely cooled in hot or boiling water, or in air, to minimize quenching strains and distortion and prevent cracking.

Aluminum alloys are comparatively soft immediately after quenching from the solution heat-treating temperature. Forgings that have become distorted during this treatment are straightened or restruck in a straightening die. The parts are then artificially aged (precipitation hardened) to obtain their maximum strength. This hardening operation consists of heating to from 250 to 340 degrees F. for from eight to twenty-four hours, followed by air-cooling to room temperature. Mechanical properties of heat-treated aluminum alloys are given below.

Heat-Treatment and Mechanical Properties of Forged Aluminum and Magnesium Alloys*

Alloy	Solution Heat-Treatment†		Precipitation Heat-Treatment			Tensile Strength, Pounds per Square Inch	Yield Strength, Pounds per Square Inch	Brinell Hardness, 500-kg. Load, 10-mm. Ball	Shearing Strength, Pounds per Square Inch
	Temperature, Degrees F.	Temper Designation	Temperature, Degrees F.	Time of Heating, Hours	Temper Designation				
14S	940	14S–T4	...	.....	.....	55,000	30,000	100	38,000
14S	940	.....	340	8 to 12	14S–T6	65,000	55,000	125	42,000
B18S	940	.....	340	8 to 12	B18S–T61	55,000	40,000	100	39,000
A51S	960	.....	340	8 to 12	A51S–T6	44,000	37,000	90	32,000
75S	870	.....	250	22 to 26	75S–T6	75,000	65,000	135	49,000
AM–C57S	...	.....	...	.....	.....	42,000	26,000	55	21,000
AM–C58S	...	.....	...	.....	.....	45,000	30,000	64	22,000
AM–C58S	...	.....	350	20 to 24	AM–C58S–T5	50,000	34,000	72	22,000
AM65S	...	.....	...	.....	.....	45,000	28,000	52	16,000

*Mechanical properties given apply to forgings up to 4 inches in diameter or thickness (3 inches for 75S aluminum alloy).

†Time of solution heat-treatment varies with the forging design, type of furnace, and size of load. A minimum of four hours is recommended for average forgings.

As previously pointed out, magnesium forging alloys do not generally respond to heat-treatment. Alloy AM-C58S, however, can be tempered to the T5 condition by heating the forgings to 350 degrees F. for from twenty to twenty-four hours. This treatment provides a very slight increase in tensile strength, with a small reduction in elongation.

Heat-treating is accomplished with combination gas-fired, radiant-tube, and electrically heated furnaces. The gas-fired portion of the furnace is employed to rapidly bring the forgings to temperature, and the electrically heated portion to soak the parts at temperature. When heat-treating certain aluminum alloys, particularly those containing magnesium, in air furnaces, there is a possibility of oxidation along the granular boundaries. This condition is characterized by minute blisters on the surfaces of the forging. The presence of moisture or gaseous sulphur compounds in the furnace atmosphere will increase the chances of blistering.

Cleaning and Inspecting Light Alloy Forgings

Light alloy forgings are cleaned and brightened to facilitate visual inspection. The forgings are first dipped in a 10 per cent caustic solution, then rinsed in a nitric acid bath, Fig. 6, and finally dried. Final inspection consists of checking visually for surface irregularities. Such defects are ground or milled from the surface.

The defects most commonly found in light alloy forgings are as follows:

"Not filled," caused by insufficient metal in the slug to fill the die impression. When this condition exists, forgings can sometimes be salvaged by restriking.

"Cold-shuts," caused by metal being forged from different directions. If present in the finished forging, the part must be scrapped.

"Flow throughs," caused by metal flowing through a web, rib, or wall instead of around it. Such defects cannot be removed, and forging must be scrapped.

Laps, caused by die picking up surface metal from one spot on the forging and spreading it over another area. Defects of this kind can be removed by milling or grinding.

Seams, caused by rolling of forging stock and insufficient scalping. Small seams can be removed by grinding.

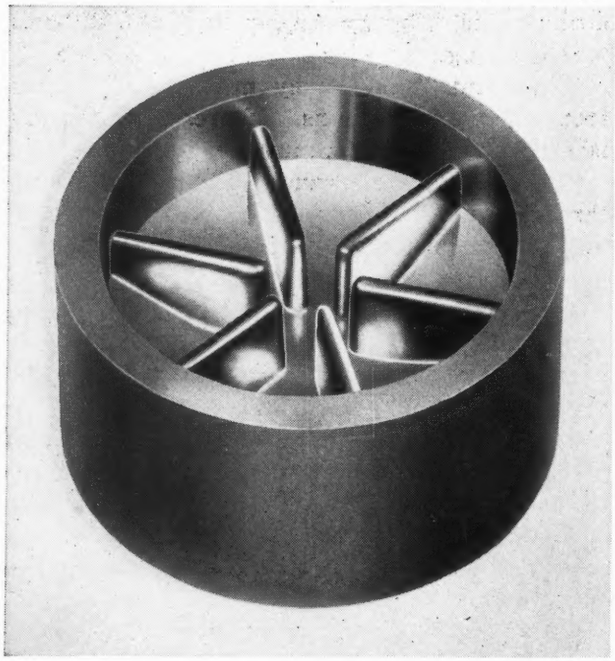
Blisters, often caused by improper furnace atmosphere during heating. When this occurs, the forging must be scrapped.

Forgings are given a 100 per cent inspection for Brinell hardness. A separate test piece, forged from the same alloy as the production parts and heat-treated with them, is given a tensile test.

A concluding installment of this article will describe the selection of alloys for forging and points to be considered in designing aluminum- or magnesium-alloy forgings.

Hobbing Mold Cavities in Alloy Steels

By JOHN SEKOWSKI
Midland Die & Engraving Co., Chicago, Ill.



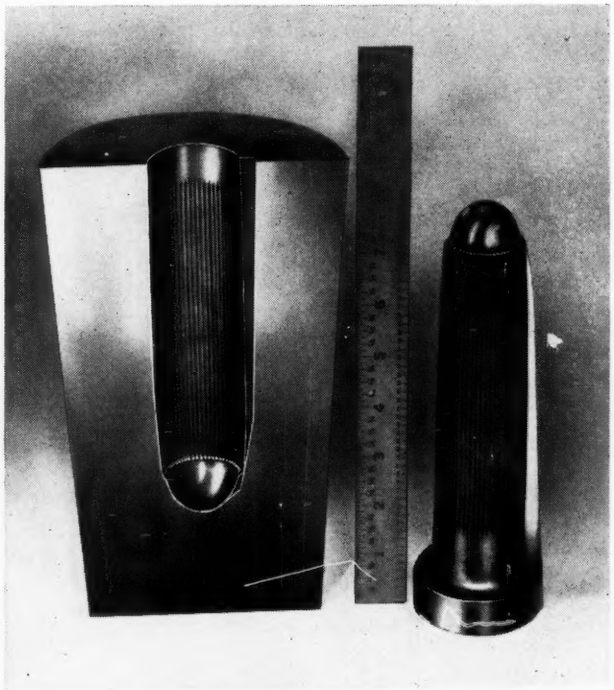
Mold for plastic parts, with cavity produced by hobbing. Note high narrow ribs in the mold cavity

FIFTEEN to twenty years ago, when the hobbing of cavities in molds for plastic parts was in its infancy, a press of 500 tons capacity was considered large, and the size of hobbed cavities was limited to approximately 8 square inches. The steel used for molds to be hobbed was generally a plain Swedish iron, of the 0.05 per cent carbon, 0.15 per cent manganese type. This steel, when carburized, had little core hardness, with the result that many cavity failures occurred during compression molding operations. Today, 3000-ton presses are commonly used for hobbing molds, and there is at least one press having a capacity of 8000 tons being employed for this purpose. Steels containing chromium, nickel, and molybdenum are now used for making the molds.

In hobbing a cavity in a steel mold, a retainer ring is necessary to confine the metal as the hob is pushed into the blank. Such rings are customarily made of heat-treated tool steel, and are designed to withstand high pressure. The openings in the retainer rings are made with an angle at all sides to facilitate easy ejection of the mold after the hobbing operation has been completed. Although the retainer rings are made with heavy walls to provide adequate strength, they occasionally break in hobbing a cavity. For this reason, all presses employed for hobbing operations should be protected with armor plate, so as to avoid injury to the press operator. The usual procedure is to provide a safety glass window in armor-plate doors.

When plain Swedish iron was used exclusively for molds with hobbed cavities, tool steels of the chromium-manganese-tungsten type were employed for the hobs. However, with the adoption of tougher alloy steels for molds and an increase in press size, it was necessary to use tougher steels for the hobs. The steel most commonly utilized for hobs today is a chromium-silicon-manganese alloy with 2.5 per cent tungsten. This is a chisel steel; for large hobs that must withstand high pressures, high-speed steel is used.

Mold for plastic flashlight case (cut in half) and hob that was used in producing the mold cavity



In the construction of hobs, the toolmaker must be sure to provide proper drafts on all hobbing surfaces. Above all, he must be careful to avoid thin sections, unbalanced sections, and sharp corners. Hob corners should have a radius of at least 0.010 inch. Draft is necessary on the side walls of hobs as if such draft is not provided, the hobs will have a tendency to tear the metal when they are pushed down into a mold blank. Another reason for providing draft on the side walls of a hob is so that the tool can be fitted into the mold cavity after annealing for subsequent pushes. Many hobs have been broken in the process of pulling them out of cavities, due generally to under-cuts or back draft on the side walls of the hobs.

When thin slots are necessary in mold cavities, it is usually more economical to machine the slots than to try to hob them. Also, thin sections of hobs may break off in narrow slots. Unbalanced sections on hobs, such as an angular surface on one side and a straight wall on the opposite side, result in operation difficulties. Angular surfaces tend to force a hob to one side, and if there should be any projections or indentations on the hobbed face, such as lines or letters, the surfaces formed by the projections or indentations will be torn in the hobbing process. Sometimes an unbalanced condition can be avoided by using a double-cavity hob.

The alloy steel most commonly used for hobbed molds by the plastic industry today is of the following analysis: Carbon, 0.08 per cent; chromium, 1.4 per cent; nickel, 0.5 per cent; and molybdenum, 0.25 per cent. This steel has proved successful for all types of plastic molds—injection, compression, and transfer. When carburized, this steel has a surface hardness of approximately 60 Rockwell C, and can be given a high polish. Readings at the core will range from 10 to 20 Rockwell C. In hobbing alloy steels, more annealing operations must be performed than in hobbing Swedish iron, but there are few steels impossible to hob, provided proper annealing procedures are followed.

The latest steel suitable for hobbing is an alloy steel of the air-hardening type which contains 0.10 per cent carbon, 5 per cent chromium, 0.20 per cent silicon, 0.90 per cent molybdenum, 0.30 per cent manganese, and 0.35 per cent vanadium. As a comparison between the "hobability" of this air-hardening steel and the alloy steel previously mentioned, it may be stated that in a hobbing operation on the two steels in which the same pressure and hob were employed, the hob was forced into the air-hardening steel only 1/4 inch, as against 3/8 inch in the case of the other alloy steel. This demonstrates that the cavity in the air-hardening steel must be annealed three times in order to achieve the same result that can be obtained with one annealing process on the alloy steel.

Burner part with an intricate rib cavity which was produced from hot-form steel by the hobbing process

The air-hardening steel has proved especially satisfactory on long-run plastic jobs and also in dies for die-casting zinc because it holds its physical properties when operating at temperatures as high as 800 degrees F. If the air-hardening steel is pack-hardened, it will attain a surface hardness of 60 to 64 Rockwell C and a core hardness of 35 to 38 Rockwell C.

* * *

In 1948, the use of Diesel engines on Class I railroads reduced the use of coal by 10,000,000 tons. In the last four years, there has been a saving of 25,000,000 tons of coal.—*Railway Mechanical Engineer*

Deep-Drawing and Waffle-Forming of Airplane Parts

Processes Employed, Equipment Required, and Factors to be Considered in Designing Parts for Deep-Drawing and Waffle-Forming

By J. J. SLOAN
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IN drawing operations on presses, the metal sheet is compressed in one direction while being elongated in another. Under these conditions, the metal can be formed to a much greater extent than when it is simply stretched in one direction. Consequently, the drawing process may often be used to form parts that would otherwise be very difficult to fabricate on drop-hammers or similar equipment.

In a typical drawing operation, the material at the center of the blank travels downward into the die with the punch, while the rest of the material travels inward as indicated by the arrow in the plan view at the center of Fig. 1. Considering a wedge-shaped segment *AOB* of the original blank (see left-hand diagram), the outer arc of this segment has a length *AB*. In the intermediate stage of the drawing operation, as seen in the central view, this length has been reduced to *A'B'*, indicating that shrinking of the metal has taken place in the circumferential direction. Simultaneously, the metal is elongated in the radial direction as it flows into the vertical wall of the cup being formed.

The circumferential shrinking introduces its own problem. Since the sheet is relatively thin, it tends to buckle under compression. To prevent wrinkles from forming, it is necessary to provide a hold-down ring, as shown in Fig. 2. By exerting the proper pressure on this ring, the tendency to wrinkle can be overcome and the material will flow smoothly into the walls of the cup. The pressure on this ring should be no more than the minimum required to prevent wrinkling; otherwise, it will produce excessive friction and cause premature failure of the material. For the same reason, proper lubrication must be used with the hold-down or draw ring.

If the hold-down ring is clamped too tightly against the material, so that slippage cannot oc-

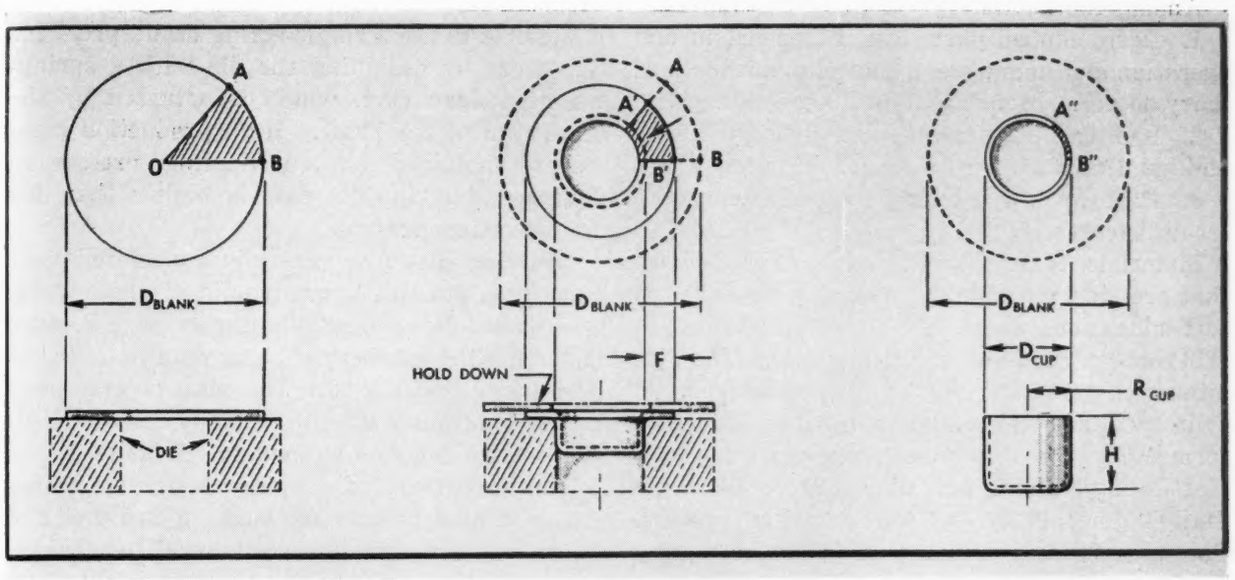


Fig. 1. Diagrammatic representation of basic drawing process, illustrating shortening of arc length (AB) on the original blank to (A'B') in the intermediate stage and to (A"B") in the completed cup

cur, the material will be unable to flow inward. Therefore, it will be possible to form the metal only to the extent of its capacity to sustain elongation in simple tension, which is much less than its ability to be formed by combined tension and compression. A common mistake in drawing parts such as boxes is to exert too much pressure on the draw-ring at the corners, resulting in an attempt to stretch the metal into shape rather than draw it.

Some parts present an interesting combination of drawing and stretching. For example, a droppable aircraft fuel tank may be formed in two half shells that are seam-welded together. By the skillful use of a double-acting press with a hydraulically actuated hold-down ring, the pressure on the draw-plate can be varied to permit drawing to occur at the nose and tail of the part while stretching and simple bending take place elsewhere (see Fig. 3).

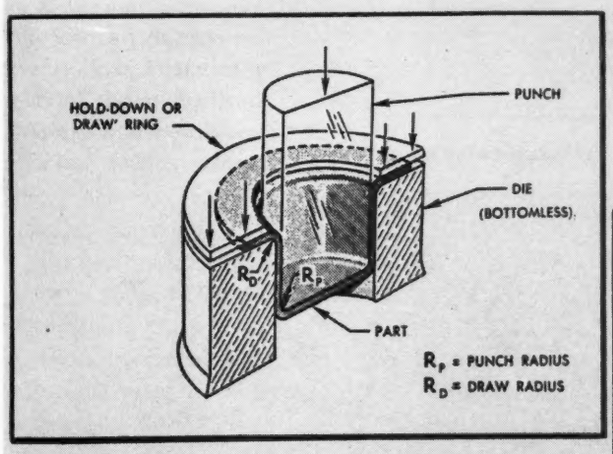
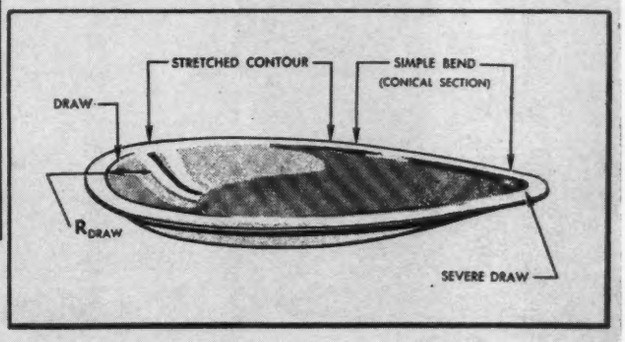


Fig. 2. Schematic assembly of die, hold-down ring, and punch

Fig. 3. Location of the various forming operations involved in drawing the half-shell for droppable aircraft fuel tanks



Among the advantages of deep-drawing are:

1. Deep, cupped parts can be formed in one operation and in one piece, thus eliminating auxiliary operations, such as annealing, welding, etc.
2. Identical parts are accurately reproduced, and hand re-work can be largely eliminated.
3. Parts can be produced rapidly, once the set-up is correctly made.

Materials commonly employed in airframes that are most suitable for deep-drawing are the soft aluminum alloys (2S-0, 3S-0, 52S-0, 3S-H14) and carbon and stainless steels. The aluminum alloy 24S-0 can be drawn into simple cylindrical cup shapes, but it has less favorable formability on box- and dome-shaped parts. Heat-treated aluminum alloy 24S-T3 has only limited formability by the drawing process. Copper and brass, in sheet form, can be readily drawn.

Double-acting presses having an independently actuated ram to exert pressure on the hold-down ring provide a flexible arrangement for drawing sheet metal. One such press employed in the sheet-metal department at North American is the Bliss press seen in the heading illustration, which has a capacity of 230 tons on the plunger slide and 177 tons on the blank-holder slide. Other presses installed in this shop are single-acting hydraulic and crank presses with air cushions for operating the hold-down device. It is possible to use a single-acting crank press for this work by designing the die with a spring-mounted draw-ring, which is actuated by the main ram of the press. High production rates can be obtained on single-acting presses so equipped, but the die cost is higher than for double-acting presses.

Drawing dies are generally considered very expensive, but this is not true in airplane work, where steel dies are usually unnecessary because of the limited numbers of parts required. It has been found that Kirksite, Masonite, or even plastics give adequate die life in many cases. Hold-down rings can also be made of Kirksite.

The importance of properly designing drawn shapes cannot be over-stressed. Extra dies and operations are sometimes employed to attain a result that is relatively unimportant to the function of the part. The part should be made as nearly cylindrical as possible if maximum depth is required. Flange widths should be held to a minimum, especially adjacent to severely drawn sections of the part. On box-shaped parts, flanges should be eliminated at the sharp corners if possible. Parts to be drawn should be designed with the maximum possible symmetry—with equal depths of draw throughout, uniform sections, flat planes, and no excessive localized draws.

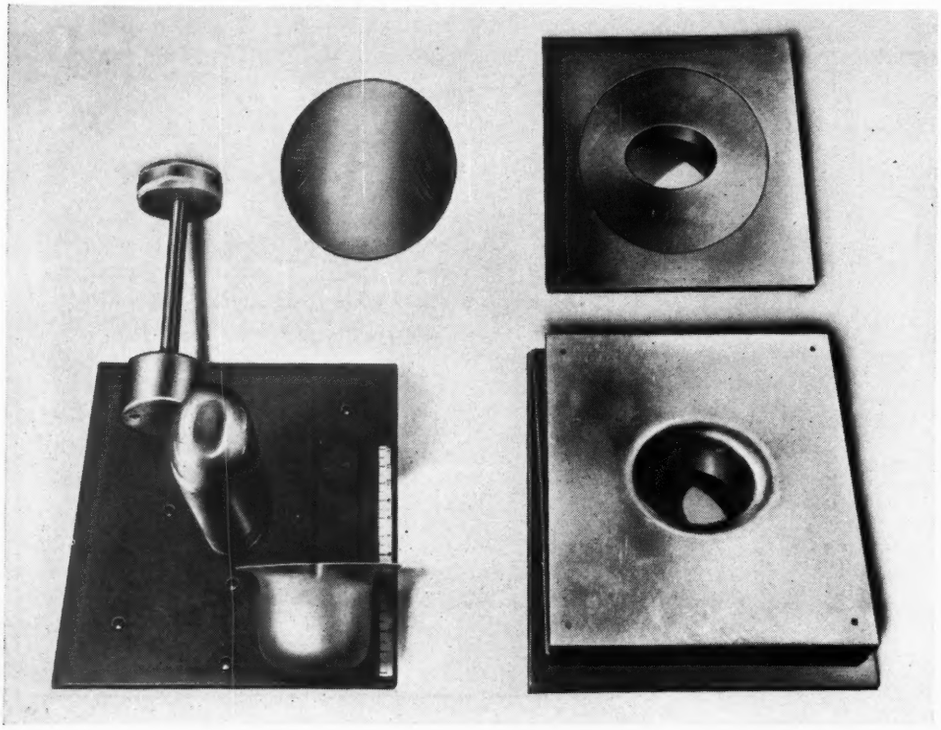


Fig. 4. Blank and incompletely formed part shown with preliminary tooling used in the multiple-stage drawing of a rocket fairing

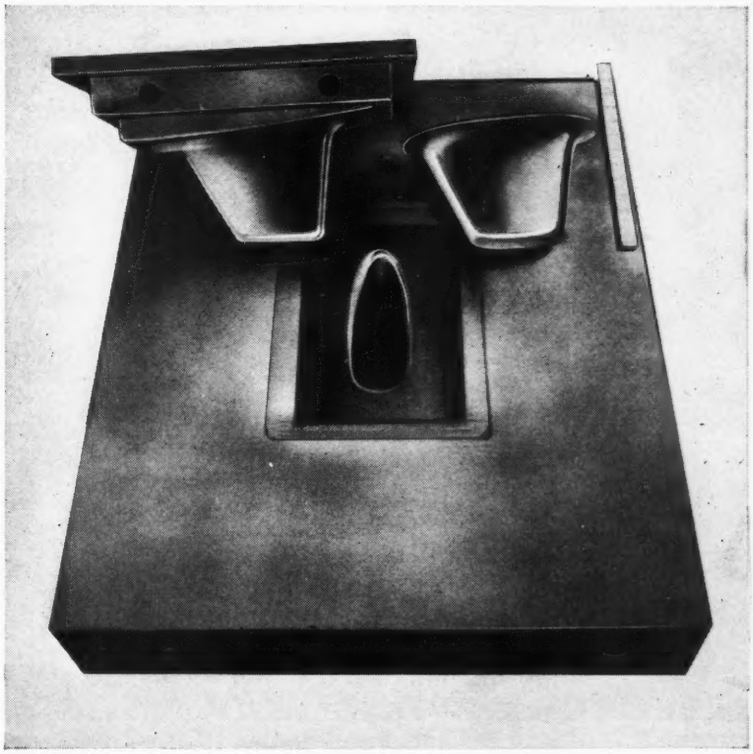


Fig. 5. Completed rocket fairing shown with final drawing die. The total depth of draw is approximately 7 1/2 inches

Radii for drawn parts and drawing dies designed by North American are selected by means of the following rules, where T equals the thickness of the material being drawn:

R_c, the vertical corner radius, and R_p, the punch radius, are never made less than five times T.

R_d, the draw radius (Fig. 2), is generally made about eight times T—never less than five times T and never more than ten times T.

R_s, the spherical radius (Fig. 8), is never made less than ten times T or two times R_c.

Depths requiring multiple drawing operations should be avoided whenever possible, since such operations increase the tooling costs and, in the case of aluminum alloys, affect the properties of the material. Such a procedure, however, is not always practical.

For example, two of the eleven dies used to form a rocket fairing are shown in Figs. 4 and 5. The blank and incompletely formed part are shown in Fig. 4 with the preliminary tools for the multiple-stage drawing of the rocket fairing, while the final die and part are seen in Fig. 5. Only the large quantity of parts required and the difficulty of using any other method justified the many complex tools and operations involved in producing this part.

Parts to be deep-drawn should be shaped so that they can be withdrawn freely from the dies after forming. The radius of hemispherical dome-shaped parts should be less than seventy-five times the thickness of the material to eliminate the tendency to pucker. Whenever practicable, specifications should permit the formation of slight wrinkles, having a maximum depth of 0.010 inch, in the flanges of the drawn part and slight distortions of the same magnitude in the flat sides of the part. Odd-shaped parts should be designed to permit their being cut from deep-drawn cup- or box-shaped parts whenever possible. Examples of odd-shaped parts that are cut from drawn shapes are shown in Fig. 6.

Practical drawing limits set up at North American for single-operation forming of cup- and box-shaped aircraft parts from sheet metal are shown in Fig. 7. This chart is based on extensive experiments conducted under production conditions. A reasonable margin has been provided to cover possible variations in the properties of the material and the production techniques.

In using the chart for cylindrical cup-shaped parts, width W will equal the diameter of the part, and R_c will equal one-half of this diameter. For rectangular box-shaped parts, the width W

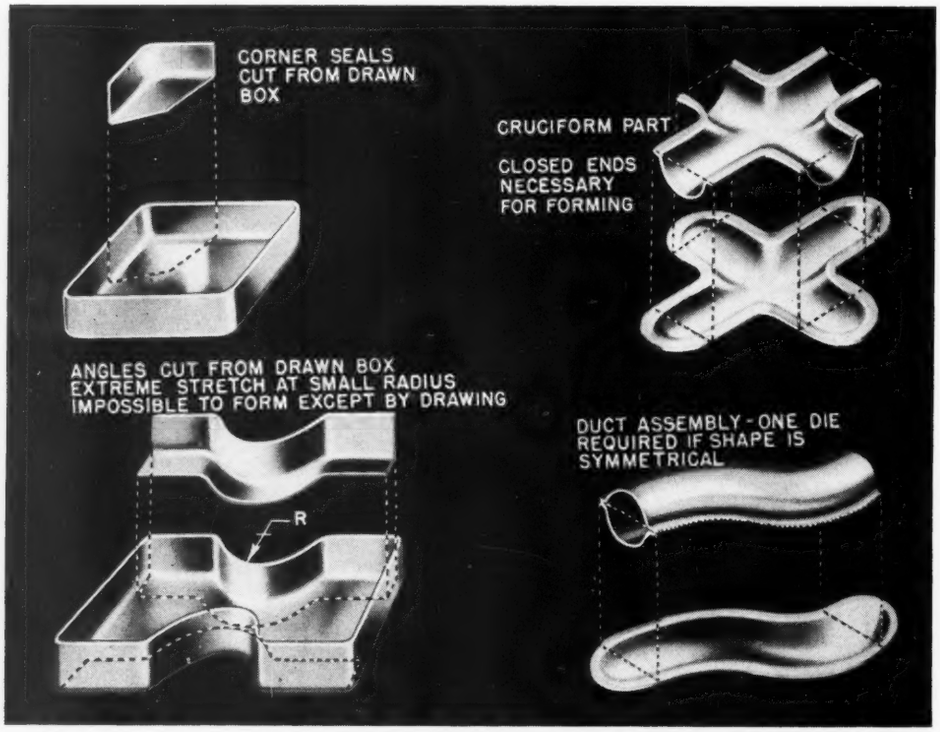


Fig. 6. Odd-Shaped sheet-metal parts should be designed whenever possible to permit them to be cut from deep-drawn shapes

should equal the square root of W_1 times W_2, Fig. 8. If the ratio of W_2 to W_1 is greater than 3, more severe limitations than those given in the chart should be employed.

To use the chart for irregular-shaped parts, width W should equal the square root of the projected bottom area. On flanged box-shaped parts, the width of the flange must be added to the depth H of the part to determine the effective depth to be used in interpreting the chart. In other words, when a limiting depth for a given corner radius is read from the chart, the flange width must be subtracted to obtain the actual allowable part depth.

The chart can also be employed for dome-shaped parts by considering the radius of the part to be equal to R_c. The depth H to be used for such parts should equal the actual depth of the part less one-half of the radius.

Deep-drawing can be accomplished on drop-hammers by using plywood rings, so stacked on the blank that the overhanging shoulder on the punch strikes against them at the same moment that the main portion of the punch pushes the

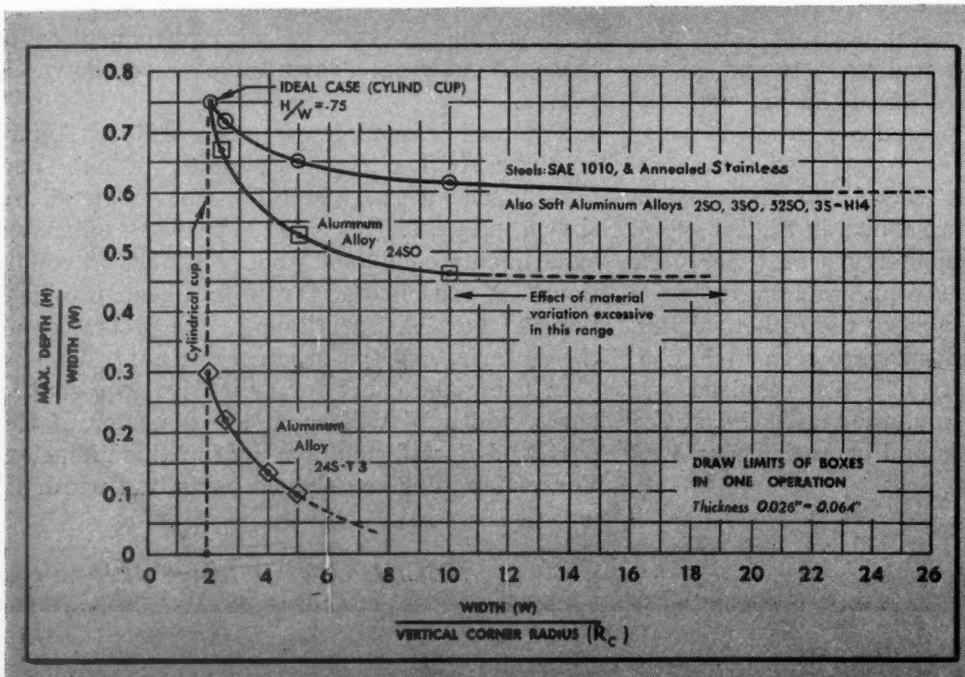


Fig. 7. Practical drawing limits for single-operation forming of cup- and box-shaped aircraft parts from sheet metal 0.026 to 0.064 inch thick

sheet into the die cavity. A restraining action tending to control buckling is thus obtained, but great skill is required on the part of the operator because of the brief duration of contact. The rings are removed, one at a time, after each hit, until the final shape is obtained. This method is limited to shapes having nearly flat flanges. Most parts deep-drawn on drop-hammers have the tendency to wrinkle on the flanges.

An alternate to this plywood-ring method is the multiple-stage drop-hammer die. As the part is formed, it is advanced from stage to stage (usually built into the same die unless very large), thus keeping the wrinkles under control.

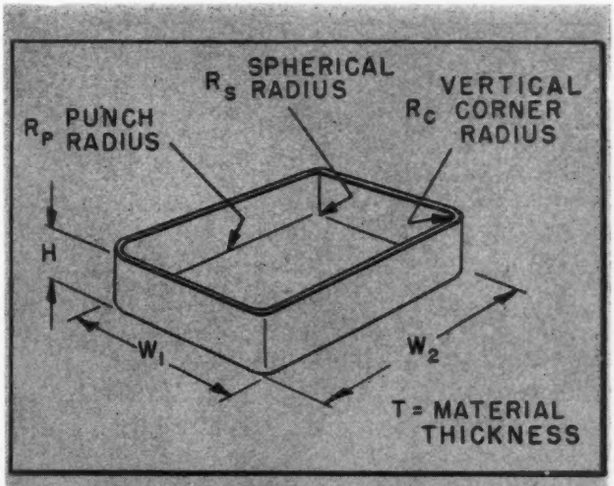


Fig. 8. Dimensions of a typical deep-drawn part referred to in chart, Fig. 7

Technique Employed in Waffle-Forming

Multi-cellular structural units, such as the rigid light-weight cowling seen in Fig. 9, can be designed to replace an assembly of many channels, stiffeners, and gussets riveted together. Such waffle stampings, formed from sheet metal on drop-hammers, can be produced more economically than corresponding riveted assemblies, because of the lower material, labor, and tooling costs.

Waffle-forming is adaptable to many aircraft structural shapes, such as doors, cowling, cooling flaps, etc. Among the advantages of waffle-forming are:

1. Tooling costs are relatively inexpensive, especially for small quantities of parts.
2. Difficult contours can be cheaply reproduced.
3. Assemblies can be combined into one part, with savings in weight and production costs.

Materials most suitable for waffle-forming on drop-hammers include the aluminum alloys 2S-0, 3S-0, 52S-0, 61S-0, and 24S-0, in thicknesses from 0.025 to 0.091 inch; and annealed, corrosion-resistant steels from 0.018 to 0.063 inch thick. Best results are obtained in the thickness range of from 0.040 to 0.051 inch.

The principles followed in designing waffle shapes are the same as those governing the forming of other parts on drop-hammers. Draft angles should be as large as possible. A minimum of 3 degrees may be used where the wall is adjacent to the outline of the part and sufficient material is available for the draw.

Internal parts of the waffle may be formed by stretching only. Stretch is calculated as shown in the diagram at the lower left in Fig. 10, and should not exceed 30 per cent for 2S-0 and 3S-0

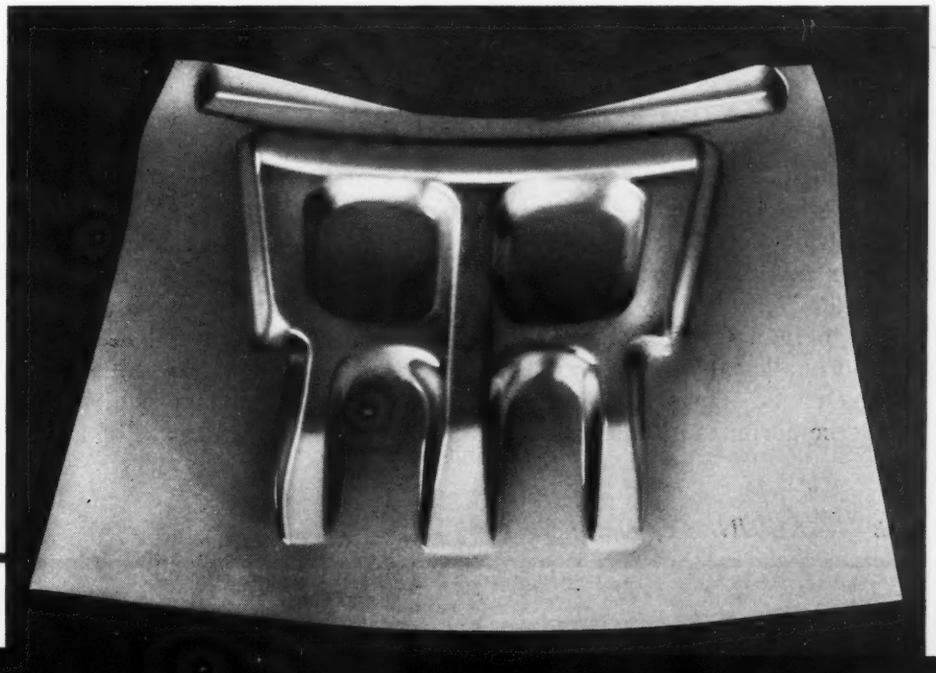


Fig. 9. Rigid, light-weight waffle stamping for aircraft cowling, which is formed on drop-hammer

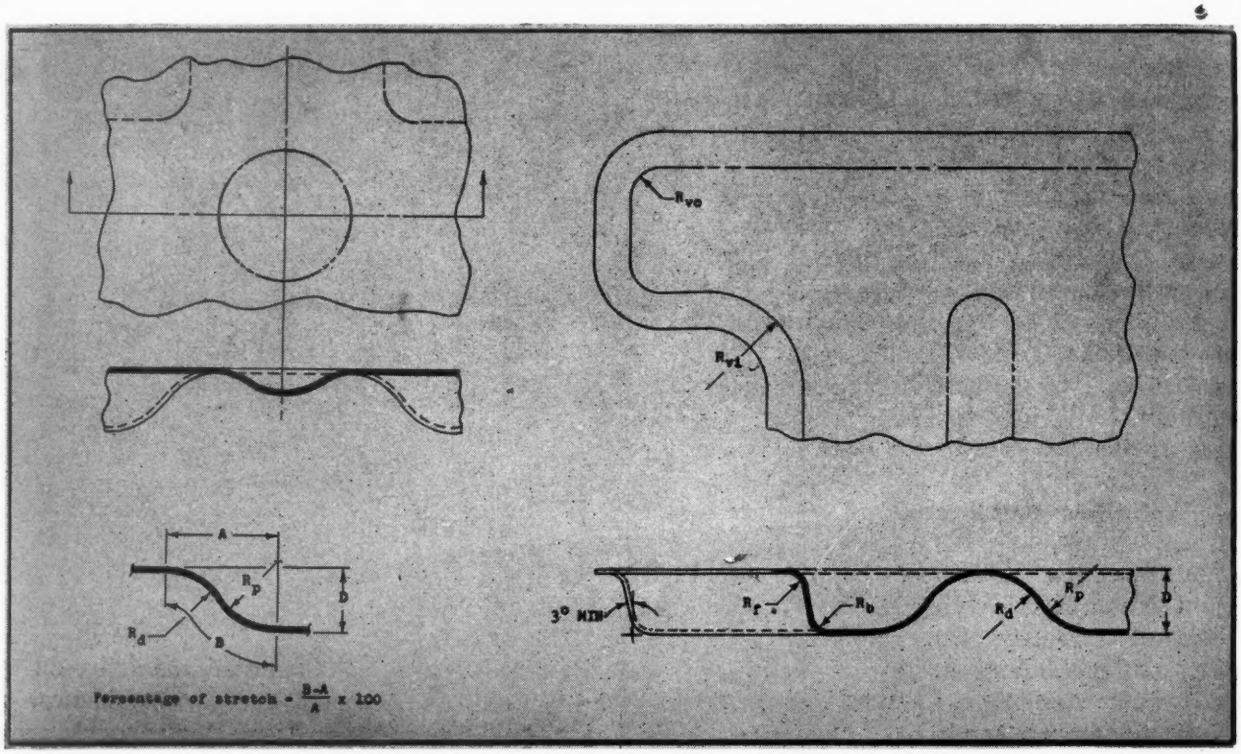


Fig. 10. Recommended design proportions for waffle shapes to be stamped from sheet metal on drop-hammers

aluminum alloys and annealed stainless steel; or 20 per cent for 52S-0, 61S-0, and 24S-0 aluminum alloys. Excessive localized draws should be avoided by designing the parts in such a way as to distribute the stretch over large areas. Thin materials buckle easily, and once formed, the wrinkle must be removed by hand hammering.

Recommended radii for waffle shapes are as follows: (See Fig. 10.)

R_{vo}, not less than $1/2D$.

R_{v1}, included angles greater than 90 degrees, $1/2D$ minimum; included angles less than 90 degrees, $1\ 1/2D$ minimum.

R_f, $5T$ where D is less than 1 inch, and $8T$ where D is greater than 1 inch.

R_b, $3T$ where D is less than 1 inch, and $8T$ where D is greater than 1 inch.

R_p and $R_d = D$.

Wrinkling should be specified as permissible in side walls and large flat areas away from mold lines or mating parts. For example, wrinkles from 1/32 inch high by 3/16 inch minimum width to 1/16 inch high by 1/2 inch minimum width are allowable in areas not in contact with mating parts. Optional use of cups or bubbles should be permitted to absorb excess material.

Basic Requirements of Abrasive Disks

The basic requirements of an abrasive disk for most efficient and economical performance include (1) fast and cool cutting action with minimum dressing, and economical rate of wear; (2) uniform cutting action radially from periphery to hole and axially from grinding face to stub; (3) readiness for use immediately upon delivery (with no aging), and with physical and grinding properties remaining unchanged indefinitely under all normal storage and operating conditions; and (4) not subject to attack by water or any commercial grinding fluid.—*Grits and Grinds*

* * *

It has been estimated that enough mechanical pencils were manufactured in this country during the last ten years to supply every man, woman, and child in the world with one each. In fact, one manufacturer produced in one year between 150,000,000 and 200,000,000 automatic pencils. Production of this stupendous number of pencils required 52,000,000 feet of tubing, an integral part of all types of mechanical pencils.

Effective Selling Assured

MANY industrial concerns that are engaged in spending large sums of money for the expansion of manufacturing facilities are, according to the magazine "Fortune," neglecting the all-important function of investing "time, knowledge, and money in salesmanship." The magazine points out that the biggest man-made force to keep the economy going is salesmanship, and that creative selling is the only remaining serious shortage today in the United States.

Over a year ago, the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association recognized the impending sales problem and laid plans for the development of capable sales engineers. A course in machinery selling was given at Cornell University in the summer of 1948 under the auspices of these Associations and of the Cornell faculty. The course proved to be so successful that it was decided to hold similar one-week conferences this year at four different universities.

These conferences have now been completed and the results have been most gratifying to the sponsors. Eighty sales engineers attended the course at Cornell University; eighty-nine at Western Reserve University, ninety-two at Dartmouth College, and one hundred four at Purdue University. All told, over two hundred separate machine tool building and selling organizations were represented by these "students."

One of the points continually stressed was that practical knowledge was essential to effective selling of manufacturing equipment to the metal-working industries. Sessions were held every day at which blueprints of proposed jobs were submitted to different groups, and the students were asked to present arguments as to why machines built by their individual companies could be used to advantage on each particular job. Different sessions considered work involving milling, grinding, shaping, broaching, drilling, and so on. In each case, the man in charge of the session was an expert on the particular phase of machining being discussed, and acted in the capacity of a "hard-boiled" buyer who had to be convinced by the salesman.

The idea behind these sessions was to develop in the sales engineer the faculty of being able to point out jobs on visits through industrial plants that could be performed more advantageously with his equipment and back up his statements with proof. That kind of selling is especially necessary during slack business periods. The sales engineer is then doubly dependent upon an active imagination, and his selling success is usually in proportion to his practical knowledge of manufacturing processes.

Practical knowledge is definitely the most important requisite in effective selling of machinery to the metal-working industries, and builders of machine tools and allied equipment in general recognize its importance. It is the basis of high quality selling, and enables the sales engineer to talk on a level with the top-notch men who are responsible for the purchase of manufacturing equipment in most industrial plants. Poor sales engineers can often do irremediable harm to the concerns whom they represent. The college sales courses should eliminate such contingencies.

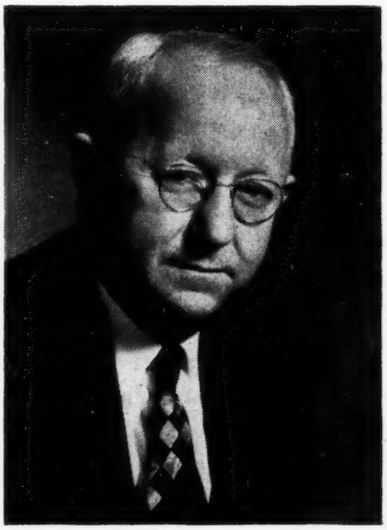
Charles O. Herb

EDITOR

Thirty-First Annual Metal Show

(Left) Arthur E. Focke, research metallurgist for the Diamond Chain Co., who will be president of the American Society for Metals for 1949-1950

(Right) O. B. J. Fraser, assistant manager of the Development and Research Division, International Nickel Co., who will be president of the American Welding Society for 1949-1950



"Economy in Production" is the theme of the thirty-first annual National Metal Congress and Exposition, which will be held in the Public Auditorium, Cleveland, Ohio, October 17 to 21, inclusive. Technical meetings will actually start on October 15, as there will be a seminar on "Thermo-Dynamics in Physical Metallurgy" held in the Hotel Statler on Saturday and Sunday by the American Society for Metals.

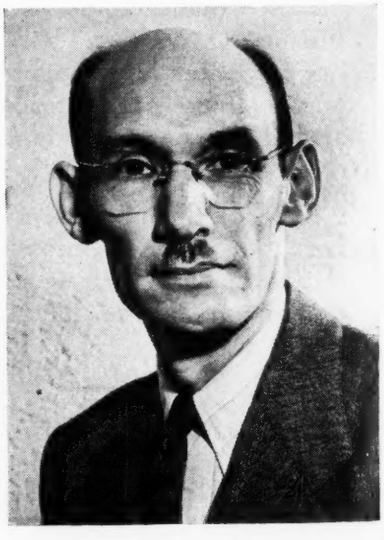
The Exposition and Congress are sponsored by the American Society for Metals; the American Welding Society; the Metals Branch, American Institute of Mining and Metallurgical Engineers; and the Society for Non-Destructive Testing. Approximately 350 firms will have exhibits in the Public Auditorium, where a total of about 200,000 square feet of floor space has been assigned to exhibitors for this show.

Technical sessions of the various societies will be held at the Public Auditorium and at the Hotels Statler, Cleveland, and Allerton. The American Society for Metals and the American Welding Society will hold technical sessions mornings, afternoons, and evenings throughout the week; the Metals Branch, American Institute of Mining and Metallurgical Engineers will have technical meetings during the day and evening from Monday through Wednesday; while the Society for Non-Destructive Testing has scheduled sessions for the morning and afternoon of both Wednesday and Thursday.

Among the papers to be presented that will be of especial interest to the production men of machine shops are: "Metal Cutting Research," by M. E. Merchant, physicist, Cincinnati Milling Machine Co.; "Cutting Fluid Theory," by Milton

(Left) Lewis E. Young, consulting metallurgist, Pittsburgh, Pa., president of the American Institute of Mining and Metallurgical Engineers

(Right) Dana W. Smith, research metallurgist, Permanente Metals Corporation, who is president of the Society for Non-Destructive Testing



Shaw, assistant professor of mechanical engineering, Massachusetts Institute of Technology; "Materials and Machinability," by F. W. Boulger, supervising metallurgist, Battelle Memorial Institute; "Metallurgy and Machinability of Steels," by J. D. Armour, chief metallurgist, Union Drawn Steel Division, Republic Steel Co.; "Tool Steels," by George A. Roberts, chief metallurgist, Vanadium-Alloys Steel Co.; "Cemented-Carbide Tool Materials," by J. C. Redmond, Kennametal, Inc.; "Heat in Metal Cutting," by A. O. Schmidt, research engineer, Kearney & Trecker; "Evaluation of Machinability," by Michael Field and N. Zlatin, Metcut Research Associates; "Tool Life Testing," by O. W. Boston, chairman, Department of Metal Processing, University of Michigan; "Some Metallurgical Aspects of Grinding," by L. P. Tarasov, research metallurgist, Norton Co.; "Economics of Machining," by W. W. Gilbert, assistant professor, University of Michigan; and "Development of the Macrostructure of Metals by Machining," by L. M. Clarebrough and G. J. Ogilvie, University of Melbourne.

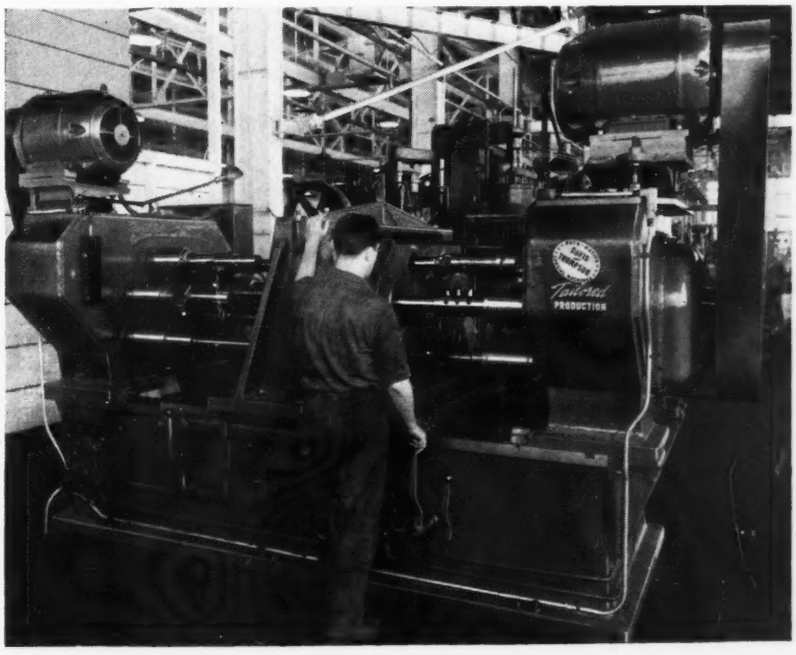
There will also be panel discussions dealing with manufacturing operations in machine shops, welding departments, etc.

Outstanding papers to be presented by the American Welding Society will include "Automatic Electric Hard Facing," by Turner G. Brashear, Jr., Leader Welding & Mfg. Co.; "Hot Hardness of Hard-Facing Alloys," by Howard S. Avery, American Brake Shoe Co.; "Hard-Facing Applications in the Steel Industry," by J. J. Barry, Air Reduction Sales Co.; "Flame-Hardening of Large-Diameter Rounds," by S. Smith, Air Reduction Sales Co.; "Arc-Welding of Molybdenum," by I. S. Goodman, Westinghouse Electric Corporation; "The Welding of High-Nickel Alloys to Other Metals," by G. R. Pease and H. B. Bott, International Nickel Co.; "Seam-Welding Monel Metal to Steel," by Ernest F. Nippes, Allan R. Pfluger, and Gerald M. Slaughter, Rensselaer Polytechnic Institute; "Lowering Cost of Welded Construction," by Omer Blodgett, Lincoln Electric Co.; and "Heliarc Welding in the Automotive Industry," by F. J. Pilia and R. H. Bennewitz, Linde Air Products Co.

* * *

Aluminum Exhibit at Chicago Museum of Science and Industry

The story of aluminum—from ore to consumer—is the newest exhibit at the Museum of Science and Industry in Chicago. This exhibit, which is sponsored by the Aluminum Co. of America, traces, step by step, the mining and reduction of aluminum ore and its fabrication into scores of products. Applications of aluminum in the building, transportation, industrial arts, sporting equipment, home appliance, and many other fields are graphically demonstrated. A special theater is incorporated in the exhibit, where two motion pictures further visualize the production and uses of aluminum—one entitled, "Unfinished Rainbows" and the other, "This Is Aluminum."



The time required for completely boring the gear-cases for cranes and shovels made by the Unit Crane & Shovel Corporation, Milwaukee, Wis., has been reduced from seventeen to six hours by the use of the machine illustrated. Special fixtures permit handling the gear-cases for all models made by this company on the same machine. Seven boring-bars are employed on each end of the horizontal boring machine, which was built by the Davis & Thompson Co., Milwaukee, Wis.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Liquid Polishing Compound	**Acme Grade 4-L-10**	A liquid compound which is easily cleaned from the work, leaves the face of the buff soft and clear, and does not clog fluid lines.	For polishing nickel, brass, copper, aluminum, and zinc die-castings. Recommended for use with pressure type composition spray equipment.
Liquid Tripoli	**Acme Nos. 2-L-70, 2-L-75 2-L-77, 2-L-79**	These liquid tripoli compounds provide considerable savings in buffs, higher color per degree of cut, and ease of application.	Can be used with any type of spray equipment.
Drawing Compound	**Acrawax C**	A synthetic wax which alone, or in conjunction with other common ingredients, markedly reduces friction and heat and decreases scratching and wire breakage in the "dry-drawing" of high-carbon steels. Higher drawing speeds, longer die life, and improved surface of the steel are also obtained.	Has been used successfully in "dry-drawing" high-carbon steel wire rope, spring wire, and tire bead wire. Also has been adopted as a lubricant for drawing bars and rods, as well as odd and round shapes of high-carbon and alloy steels. When added to plastic-molding compounds, it gives anti-static properties to finished surfaces.
Acid Plating Agent	**Actane**	An additive for use in acid dips prior to plating. When used in hydrochloric or sulphuric acid, it disperses and removes colloidal films deposited on metal surfaces during cleaning, thus preventing spotting, streaking, or staining of the plated surfaces.	Particularly satisfactory for use when dipping non-ferrous metals, such as copper and brass, prior to bright nickel-plating.
Industrial Ceramics	**AI-200 Alumina**	One of several high-strength industrial ceramics with high heat resistance. These ceramics also have good resistance to corrosion and abrasion, low coefficient of friction, and high compression strength.	For high-pressure use in valve parts and bearings. Also employed for grinding balls, nozzles, extrusion dies, surface plates, plug and ring gages, and pump parts.
Hard-facing Alloys	**Aircolite** **Airco Self-Hardening Alloy**	Two of a group of fifteen hard-facing alloys that may be divided into three types—ferrous alloys, cobalt-base alloys, and tungsten carbides.	Aircolite is especially recommended for equipment subjected to severe abrasion and medium impact, such as pulverizer hammers and core crusher rolls. Airco self-hardening alloy is for equipment subjected to severe impact and abrasion, such as bucket teeth and sizing screens.
Cast-iron Flux	**All-State No. 1A**	A cast-iron flux in paste form for gas welding. Is painted on clean surface of iron while casting is still cold. May also be painted on welding rod to provide additional flux as work progresses.	Used in the repair of broken castings, salvage of defective castings, repair of pitted cast-iron molds, and correction of machine shop errors.
Silver Solder	**All-State No. 20**	A 20 per cent silver content solder with melting temperature of 1430 degrees F. and shearing strength of 145,000 pounds per square inch.	Particularly suitable for brazing carbide tips to steel shanks and for fabricating light steel parts. Can also be used on brass, copper, stainless steel, and Inconel.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Aluminum Soldering Flux	**All-State No. 39**	A flux for use with aluminum solder which aids the flow of solder throughout the joint.	Is particularly useful for joining aluminum with ferrous and nonferrous metals at low working temperatures.
Silver Solder	**All-State No. 111**	A silver solder having a shear strength of 105,000 pounds per square inch and a melting temperature of only 1076 degrees F. Has a silver content of 40 per cent, with the remainder cadmium, copper, and zinc.	Recommended for soldering high-speed steel tool tips with critical temperature ranges to shanks.
Magnet Alloy	**Alnico 5**	A sintered permanent-magnet material permitting the economical production of small-sized, fine-grained parts. Has unusually high tensile properties, and can be produced with smooth surfaces and close dimensional tolerances.	Especially adaptable where small powerful magnets having high magnetic properties are required.
Aluminum-Bronze Alloy	**Ampco Grade 24**	An aluminum-bronze alloy with high hardness, unusual compressive strength, and marked wear resistance, for use in forming and drawing dies.	Particularly useful in forming and drawing stainless steel, but also adapted for producing parts from carbon steel.
Aluminum-Bronze Alloy	**Ampcoloy 49**	An aluminum-bronze alloy with high tensile strength, which is further increased by cold-working; higher resistance to wear than ordinary bronze; high fatigue and impact values; and good corrosion resistance.	Developed especially for cold-headed parts, such as bolts, rivets, screws, and all types of fastenings. Also makes an excellent spring material.
Aluminum Coating Process	**Anonizing**	A process developed to provide a protective transparent coating on aluminum resembling an anodized coating. The clear, glaze-like coating is not brittle and has good resistance to abrasion, smudging, oxidizing, and ordinary handling.	Practically all alloys of aluminum can be treated, and in most of them the surface color is maintained or improved. Provides an excellent base for paints and lacquers. Application is by immersion in a hot solution, followed by rinsing.
Welding and Soldering Compound	**Anti-Capillary Compound**	This compound limits the flow of molten metal or solder, and helps retain it in the working area.	Can be used with any form of oxy-acetylene gas torch, soldering torch or iron, furnace, or high-frequency equipment.
Cutting Compound Base	**Antisep All-purpose**	A base for cutting compounds with high sulphur and saponifiable content, which can be diluted with either oil or water. Has rapid cooling qualities and satisfactory lubricating properties, even when mixed with water. Also possesses rust-preventive properties, thus eliminating the corrosion, staining, or pitting of parts to which it is applied.	Is applicable to more than 90 per cent of metal-cutting and forming operations, including general machining, stamping, and drawing.
Bearing Bronze	**Asarcon 773**	Continuous-cast bearing bronze having 83 per cent copper, 7 per cent lead, 7 per cent tin, and 3 per cent zinc to meet SAE 660 specification. The continuous cast process insures a dense, solid metal, free from porosity.	For use in bearings.
Wire-drawing Compound	**Banox**	Phosphate material that inhibits rust and helps lubricate wire in process of manufacture. Said to permit 20 to 25 per cent increase of speed in drawing fine high-carbon wire.	This material is applicable where protection of wire against rusting, increase in wire drawing speed, and reduction of damage to dies and wire are called for.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Spring Material	**Berylco 165**	A beryllium alloy with reduced beryllium content, meeting all performance requirements of ASTM Specification B 194-46T. Lower beryllium content results in increased tool life and lower cost. Available in heat-treatable form and also in mill-hardened form.	The heat-treatable alloy can be used for any stamped, drawn, formed, or blanked part. It is adaptable for fixture hardening or bulk hardening, and for short-time, high-temperature hardening cycles. The mill-hardened alloy is suited for small, high-production parts, such as eyelets, rivets, and cold-headed parts.
Steel Coloring Process	**Blu-Blak**	An oxide coloring process developed originally as a gun-bluing method. Provides a uniform coloring to a maximum depth of 0.0001 to 0.0004 inch, and colors from the inside out.	Applicable to all steels including case-hardened and cyanide-hardened parts. Coloring is by immersion in process bath for fifteen to sixty minutes.
Thread Compound	**C-5 Hi-Temp**	Thread compound that prevents freezing and galling of metal surfaces at temperatures as high as 1800 degrees F.	Specifically intended for high-temperature and high-pressure applications, such as furnace tube header studs and plugs.
Cadmium-plating Process	**Cadux HS**	A new and improved bright cadmium-plating process providing a marked increase in brightness of the deposit; higher permissible current densities; and improved covering power and appearance on rough and imperfect surfaces. Under best conditions, mirror-bright deposits are obtained.	For use wherever cadmium-plating is called for. In some cases, a lower grade steel may be employed and satisfactory finish obtained.
Carburizing Paste	**Carburit**	A paste for rapid casehardening of steel. Hardness produced compares favorably with that obtained by other methods. Rapid penetration is obtained.	Readily used for selective hardening. No special equipment required. Any source of heat can be used. Particularly suitable for repair work.
Sintered-carbide Alloy	**Carmet Grade CA-51**	Typical cutting data for planer tools of this material when cutting 60 per cent semi-steel casting: Depth of cut, up to 1 1/2 inches; feed, 0.100 inch; surface speed, 175 feet per minute.	Especially designed for high-speed planer tools. Other applications are tool blanks for heavy turning, boring, and facing.
Acid-resistant Steel	**Carpenter Stainless No. 20**	A sulphuric-acid resistant stainless steel in the form of bar stock, wire, strip, tubing, and pipe. Also available in sheet and plate form. In addition to superior corrosion resistance, it retains the good mechanical properties of 18-8 stainless steels.	Typical uses include pump shafts and rods, valve stems, tie-rods, pipe lines, fittings, and screens. Used extensively in manufacture of heavy chemicals, organic chemicals, synthetic rubber, high-octane gasoline, solvents, explosives, and plastics.
Strippable Coating	**Chem-Peel**	Strippable protective coating which, after application in the form of an emulsion, dries to a protective plastic film.	Can be used on spray-booth walls as a coating to permit ready removal of overspray. Also protects metal parts from corrosion, dirt, and surface injury.
Die Steels	**Cobalt-Chrome** **G.S.N.** **Olympic** **Select B**	Dispersed segregate die steels possessing high impact strength. Cobalt-Chrome is a special high-carbon, high-chrome, cobalt air-hardening type. G.S.N. is a high-carbon, high-chrome oil-hardening type. Olympic is a high-carbon, high-chrome air-hardening type. Select B is a modified-chrome air-hardening type. An even dispersion of free carbides in these steels eliminates the grouping together of carbides in a brittle center mass.	For application as die steels wherever more uniform steel, with less warpage and breaking and more consistent results under heat-treating, is called for.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Wire Metallizing Rod	**Colmonoy**	A plastic bonded rod composed of powdered Colmonoy No. 6 for use in wire metallizing equipment.	Upon application, the flame of the metallizing gun burns out the plastic, leaving Colmonoy particles deposited on the sprayed surface. These particles are then bonded to the base metal by the use of an oxy-acetylene torch, induction heating equipment, or a controlled-atmosphere furnace.
Pulley Lagging	**Condersite**	All-purpose waterproof pulley lagging readily applied without rivets, bolts, or heat. Unaffected by weather and resists attack by sulphuric acid, soaps, alcohol, and petroleum products.	Provides superior frictional resistance and increased transmission efficiency for crown, split, or flat pulleys when used with leather, cord, wire-woven, or rubber belts.
Cutting-oil Additives	**Cresol Z-2** **Cresol 2-A**	Two cutting-oil additives suitable for production of coolants, drawing compounds, and metal-rolling, forming, and extreme-pressure lubricants. They are modified sulphur-chlorides. Owing to their chemical composition, they do not stain ferrous metals, gum, nor decompose. When added to light mineral oils, a transparent liquid is obtained which permits observation of work being machined or fabricated.	Particularly adapted to the machining of Monel metal and chromium, chrome-molybdenum, chrome-nickel, tungsten, and stainless steels.
Transparent Plastic	**Crystal Tenite II**	New transparent form of Tenite II.	For use in products that require transparency approaching optical clarity.
Plastic Lining	**Cycloflex PC-11**	A plastic that sets to a rugged, chemically inert membrane, highly resistant to inorganic acids, alkalies, grease, oxidants, and cleaners.	Available in white or black for coating the inside of drums or tanks.
Plastic Coating	**Cyc-Lon (Series NPC)**	Easily applied synthetic paint that dries quickly in air by solvent evaporation, forming an adhesive, hard wearing, flexible glossy coating. Requires no surface priming.	For protecting metals, wood, and ceramic surfaces against chemical attack by corrosive fumes, condensates, etc.
Silicone Oils	**DC 710** **DC 710G** **DC 710R**	New silicone oils especially adapted for high-temperature lubrication and providing heat stability to 500 degrees F., resistance to oxidation, freedom from gumming, low volatility, water repellency, and good lubricating properties at medium to light loadings.	DC 710 is adapted especially for high-temperature lubrication. Can also be used as high-temperature bath liquids and as high-temperature hydraulic fluids. DC 710G provides excellent lubrication and protection for mechanisms continually exposed to heat, high humidity, or to the atmosphere. DC 710R permanently lubricates such sealed-in precision devices as clocks and instruments.
Metal Lacquer	**Dennis No. 5062**	This lacquer will withstand twenty-four-hour immersion in gasoline and fifteen-minute immersion in hot oil (275 degrees F.) without apparent deterioration of film strength or gloss.	For use on metal surfaces where oil resistance, toughness, and maximum adhesion are required.
Cleaner and Coating Compound	**Detrex 79**	Yellow, non-corrosive cleaning and phosphate coating material in powder form. Used in heated water solutions at low concentrations, it produces a high crystalline phosphate film.	Used to provide a base coating on steel and other metals preparatory to painting.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Pre-lubrication Compound	**dgf-123**	A dispersion of synthetic colloidal graphite in alcohol and carbon tetrachloride. Rapid evaporation of liquid carrier leaves dry protective coating of graphite.	As a pre-lubricant, it serves dual purpose of reducing surface tension to permit retention of thicker film of oil and of acting as a wetting agent to distribute oil film. Also serves as temporary lubricant in case of failure of oil supply.
Liquid Detergent	**Drex Foam**	Liquid cleaning compound with effective cleaning and wetting properties that leaves no streaks, smears, or other blemishes and contains no abrasives or harsh alkalies.	Intended for use as a general-purpose cleaner and for removing dirt, grease, and grime from automobiles, trucks, and aircraft.
Magnesium-treated Cast Iron	**Ductile Cast Iron**	A cast iron that combines the fluidity, castability, and machinability of ordinary cast iron with the advantages of cast steel.	For use wherever castings with high elasticity, yield strength, and ductility are required.
Bottom Boards	**Edco Dowmetal**	Magnesium boards which eliminate burning, warping, splitting, and loose joints that cause mold shifts, breaks, and cracks. Unharmed by normal run-outs and spills.	For use in foundries to hold flasks when pouring and molding sand castings in ferrous and non-ferrous metals.
Vibration-isolating Material	**Elasto-Rib**	Laminated material consisting of a layer of cork bonded between layers of deep-grooved, oil-resistant synthetic rubber.	For low-cost vibration and noise control. Recommended loading 7 to 21 pounds per square inch.
High-speed Steels	**Electrite MV**	A line of high-speed steels, distinguished by chromium, molybdenum, and vanadium content, with absence of tungsten.	Well adapted for applications not requiring full properties of more common tungsten-bearing high-speed steels. May be used for small drills and reamers, thread chasers, taps, woodworking knives and cutters, and body stock for carbide-tipped tools.
Spring Alloy	**Elgiloy**	Non-magnetic corrosion and fatigue-resistant spring alloy.	For use both in springs and in corrosion-resistant valves.
Metal Stripper	**Enthone**	Compound for dissolving nickel and other metal coatings on steel without attacking the steel. The stripper is alkaline and requires no electric current.	Effective in removing nickel, copper plate, silver, cadmium, and zinc from steel. Not suitable for removing nickel coatings from zinc-base or copper alloys.
Acid Inhibitors	**Enthone No. 9**	A liquid inhibitor that readily dissolves in acid solutions. In both hydrochloric and sulphuric acids, the inhibiting action is over 90 per cent, and in some cases as high as 98 per cent. Dissolves without sludge or residue.	Particularly useful where exhaust ventilation is not available. Suitable for use in both cold and hot pickles. Steel coated with scale, oxide, and rust can be quickly pickled without attack upon the base metal.
Plastic Plating-rack Coating	**Enthonite 101**	Plastic coating supplied as a viscous liquid containing 100 per cent solids with no solvents to evaporate. Coating is tough, resilient, and has high resistance to all types of inorganic solutions, particularly plating solutions.	For application to plating racks in coatings from 1/8 to 1/4 inch thick.
Screw Steel	**E Steel**	Screw steel available in cold-finished bar form with machinability index as high as 170. Shows better finish after machining and has better cold-working and cold-forming properties than standard Bessemer screw steels.	For use in manufacture of nuts, screws, studs, fittings, and other screw machine products.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Nylon	**FE-1044**	Pliability combined with good wear resistance. Has many properties of rubber, with excellent chemical resistance to hydrocarbons.	Seating disks for low-pressure valves and gaskets in contact with oil, gasoline, or various hydrocarbons.
Cutting Oil	**Ferox**	A water-soluble cutting oil which also acts as a rust preventive. No soaps or alkalies are used to keep the cutting oil in suspension, so that the solution remains clear.	For use in machining operations wherever a water-soluble cutting oil is called for.
High-temperature Insulation	**Fiberglas**	A group of light-weight insulating materials composed of glass filaments which will withstand temperatures up to 1800 degrees F. Designed for industrial, marine, and aircraft applications.	Suitable for insulating housings and flange covers of high-temperature steam turbines, as well as exhaust manifolds and turbosupercharger housings on oil- or gas-fired supercharged four-cycle Diesel engines. In some applications, provides a removable insulation that can take the place of refractories. Also adapted for use as a filtering element in some cases.
Insulating Material	**Flotofoam**	A plastic foam insulating material that combines exceptionally low thermal conductivity with very light weight. The material is non-corrosive, non-toxic, and self-extinguishing.	As thermal insulation for low-temperature installations.
Wire Stripper	**Formula 21**	A non-corrosive, non-inflammable liquid for removing wire coatings.	Application is by dipping the wire in the liquid. Coating is then wiped or blown off.
Rare Metal	**Gallium**	Rare silvery-white metal with melting point of 86 degrees F. Wets many types of non-metallic surfaces, such as glass and porcelain. Similar in chemical behavior to aluminum, but has about twice its density.	Because protective natural oxide film forms readily on surface, a globule of Gallium will remain bright and shiny at temperatures up to 1000 degrees F.
Soldering Compound	**Galvalloy**	A soldering compound for aluminum and magnesium soldering applications. Withstands corrosive action of degreasing vapors.	After tinning a magnesium surface with this compound, pure zinc, ordinary solder, or pot metal can be used as a filler.
Rubber Molding Compound	**G-E 12446**	High shock resistance due to toughness and resiliency of Hycar-American rubber used in the compound. Also has good moldability, heat resistance, and thermal shock resistance.	Can be molded around large complex inserts without danger of cracking, and around inserts subject to flexing and vibration.
Sintered Alloy	**G-E Hevimet**	An alloy of tungsten, copper, and nickel having a density 50 per cent greater than lead. Combines greater tensile strength with good machinability and is highly resistant to corrosion. Is easily plated with cadmium, chromium, and nickel, and can be silver-soldered or brazed by standard methods. Obtainable in a variety of non-porous sheets and blocks.	Applicable to the design and construction of moving parts possessing maximum inertia and minimum size such as balance weights for crankshafts, air screws, centrifugal clutches, and other rotating parts.
Hardening Compound	**Hi-Speed-It**	Steel hardening compound in powder form that can be readily applied without special equipment.	Cutting tools, dies, taps, reamers, drills, and files can be treated by dipping or rolling in the compound after tools have been heated to required temperature. Quenching is accomplished in cold water or brine.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Liquid Solvent	**Hydro-Solv A**	Is composed of several highly active gum and sludge solvents. Its use makes unnecessary the draining, flushing, and cleaning of a contaminated hydraulic system.	For use in hydraulic oil systems to carry gum and sludge into suspension or solution.
Isolating Paste	**Isopac**	Prevents penetration of carbon gas to metal surfaces and also prevents rapid cooling. Easily removed after work is quenched.	For protection of selected areas of work to be kept soft during casehardening.
Rust Preventive Compound	**Kano Rustproof**	A liquid compound applied cold by dipping, spraying, or brushing. Forms a tough, flexible, and non-porous surface that prevents rust on polished surfaces due to handling. Is readily removed by any petroleum solvent.	For protecting tools and machine parts.
Carbide Tubes	**Kennametal**	Tungsten-carbide and titanium-carbide tubes as small as 1/32 inch outside diameter with inside diameter of 0.004 inch, and as large as 9/16 inch outside diameter with wall thickness of 1/16 inch.	Tungsten-carbide tubes are used for parts subject to abrasion at normal temperatures, such as wire guides, orifices, nozzles, punch and die parts, etc. Titanium-carbide parts are used for high-temperature applications, such as furnace rollers, guide bushings for hot rods, nozzles, burner cones, etc.
Plastic Pipe	**Kralite**	Corrosion-proof plastic pipe made of a blend of synthetic rubber and thermoplastic resins. Can be bent to various radii and can also be threaded for fittings.	For use in chemical manufacturing, mining, or other industries where resistance to chemical attack and weather is required.
Plastic Protective Coating	**Krylon**	Dries in less than a minute, leaving clear satin finish, resistant to discoloration at high temperatures and to action of water, alcohol, acids, alkalies, mineral oils, grease, and chemical fumes.	For protection of initial parts during storage. Also useful in protecting fine instruments and tools against corrosion.
High-temperature Thermoplastic	**Kel-F**	Unusually stable, high-temperature thermoplastic with satisfactory properties in the temperature range of —320 to 390 degrees F. It is colorless and transparent, but can be blended with solid fillers and coloring agents. Has low cold-flow characteristic.	For pump packings, valve seats, and valve packings subject to corrosive gases and liquids, and pump diaphragms where a resilient material is required.
Cold Solder	**Lab-Metal**	Hardens rapidly into a strong permanent bond that can be sanded to a feather edge, ground, and painted. Can be thinned with any regular lacquer thinner.	For filling blow-holes, sand holes, surface blemishes, and rough or porous places in metal castings.
Plastic Coating	**Liquid Coating**	A plastic coating to minimize or eliminate scratches, die marks, and other surface defects on stainless-steel sheets. Also acts to reduce power requirements in deep-drawing operations.	Is particularly effective during stamping, drawing, and forming operations. Can be applied by brushing, spraying, or dipping, and is readily removed.
Protective Coating	**Liquid Stainless Steel**	Liquid plastic containing flakes of stainless steel of microscopic size. Has good adhesion to wood, metal, and other surfaces, and is quick-drying.	For application to any surface by brushing or spraying.
Polystyrene Treatment	**Logoquant**	A treatment for the surface of polystyrene parts which provides a high mar resistance. Also produces a surface that is considerably less electrostatic than untreated polystyrene and that resists solvents, such as gasoline, mineral oils, carbon tetrachloride, and toluene.	Fully developed for production-line application either by spraying or dipping without special equipment or curing.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Permanent Repair Alloy	**Lo-Temp**	Low-temperature, bronze-base permanent repair alloy. Can be handled like putty at 300 degrees F., and fuses with metal surface under repair. Will not corrode, crumble, shrink, or dry out.	For use in industrial repair and maintenance operations. Can be applied to any metal except aluminum and its alloys.
Lubricant for Hydraulic Systems	**Lubeway**	Dual-purpose oil which has the stability and non-sludging characteristics of a good hydraulic oil, and also possesses the metal wetting and extreme pressure qualities of a good way lubricant.	For use in hydraulically operated machine tools in which way lubricant is fed by pressure from the hydraulic system.
Sintered Alloy	**Mallory 1000 Metal**	A sintered alloy with increased strength and a density approaching that of tungsten. Unlike tungsten, it is readily machinable. Has high resistance to atmospheric corrosion and to certain acids, making it useful for electrolytic process fixtures.	Widely applied in making balancing components in rotors for such devices as gyro-pilots and governors. Its high modulus of elasticity and high density and tensile strength make it useful for heavily stressed parts. Also useful for radium containers.
Abrasive Disk Cement	**Master**	A cement with uniform high adhesive properties that helps to insure grinding accuracy.	For applying cloth-backed and flexible paper abrasive disks to steel-disk grinding machines.
Metal Cleaners	**Matawan 20-W** **Matawan 25** **Matawan 30** **Matawan 30-W** **Matawan 50-W**	The first of this series of metal cleaners is a mild non-etching cleaner; the second, a non-silicated medium-caustic base cleaner; the third, a silicated medium-caustic base cleaner containing no foaming or wetting agent; the fourth, a silicated medium-caustic base cleaner containing a suitable wetting agent; and the fifth, a non-silicated high caustic type cleaner.	Matawan 20-W is used for the soak cleaning of aluminum or as a soak or cathodic cleaner for zinc-base die-castings and brass parts. Matawan 25 is designed for etching aluminum for appearance or to prepare for spot-welding or anodic paint coatings. Matawan 30 is for spray type washing of steel parts. Matawan 30-W is used on iron, steel, brass, or bronze as a soak or as an electro-cleaner. Matawan 50-W is used as a soak cleaner for magnesium.
Metallizing Wire	**Metco-Weld H**	A metallizing wire composed of a powdered hard-facing alloy extruded with a plastic binder. Permits application of smooth, uniform, relatively thin, hard coatings possessing high resistance to abrasion and corrosion.	Is applied by spray gun which volatilizes the plastic binder, leaving a purely metallic deposit. Subsequent fusing is obtained with a torch or an attachment to the metallizing gun.
Molding Alloy	**Moldaloy**	An alloy that melts at 430 degrees F.; has a hardness of 22 Brinell; a compressive strength of 8000 pounds per square inch; a tensile strength of 11,500 pounds per square inch; and a shrinkage of approximately 0.001 inch per inch.	Recommended for molds for casting low-temperature melting plastics; rubber molds; wax molds for precision casting; models for engraving machines; master patterns; forming dies for thin sheet metals and thermoplastics; and chuck jaws for holding irregular pieces.
Dry Lubricant	**Molykote**	Dry lubricant consisting essentially of molybdenum disulphide powder. Has extremely low coefficient of friction and unusual capacity to prevent galling, seizing, or metal-to-metal contact at bearing pressures over 100,000 pounds per square inch.	Adheres tenaciously to smoothest surfaces with light rubbing. When used on screw fasteners or in press fits, assembly takes place smoothly, without binding, at increasing torque.
Emulsion Cleaner	**Mul**	Ready-to-use compound that combines solvent and emulsion cleaning properties with action of soil-penetrating agents. Resists hard water attack, minimizes curd formation, and is inhibited against foaming.	Can be used for washing as an additive to rinse tanks or as a dip. Also suitable for pre-wetting metal products before alkaline cleaning or vapor degreasing.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Inoculating Alloy	**Nisoloy**	An alloy containing approximately 60 per cent nickel, 30 per cent silicon, and 10 per cent iron, with a low melting point and relatively high specific gravity.	Used as an inoculating alloy for gray iron to improve its machinability. The alloy penetrates and diffuses rapidly through the melted metal.
Welding Fluxes	**No. 3** **No. 5** **No. 7** **No. 9**	Brazing and welding fluxes for various metals.	No. 3 is for brazing brass, bronze, steel, and clean cast and malleable iron. No. 5 does an excellent job of "tinning" dirty castings. No. 7 is for high-heat brazing of cast and malleable iron. No. 9 is for fast, effective welding of cast iron.
Color Buffing Compound	**6-B-72**	Bar composition with a binder that retains abrasive on buff face, permitting it to cut without building up a heavy waxy face.	For color buffing carbon steel, stainless steel, and chromium plate. Will also rapidly cut and color burned chrome.
Metal Cleaning Compound	**No. 101A**	A medium-duty alkaline cleaner that includes special water-softening materials and inhibitors to prevent attack on metal.	Particularly effective for removing dirt, grease, and oil. Especially designed for cleaning aluminum. Can also be used as a soak cleaner for non-ferrous metals, such as zinc, brass, bronze, pewter, etc.; in this case, the work is made the cathode and cleaned electrically.
Plating Rack Coating	**No. 266**	An air-drying rack coating that is resistant to all plating solutions, including hot alkaline cleaners; adheres well to all surfaces, and is flexible and resilient.	For the production of electroplating racks. Can be applied to required thickness in two dips and needs only twenty to thirty minutes' drying time.
Tool Steels	**No. 610** **No. 484** **Vega** **T-K** **No. 883**	No. 610 is recommended when extreme wear resistance and good toughness are needed. No. 484 is for tools requiring an ideal combination of wear resistance and toughness. Vega is intended for tools requiring extreme toughness with good wear resistance. T K combines greater hardness with improved toughness. No. 883 offers extreme toughness and greater red-hardness.	Part of a new and improved set of matched tool steels. Three air-hardening tool steels for applications where minimum distortion in heat-treatment and elimination of hardening hazards are essential, and two new steels having greater hardness and toughness at high temperatures.
Water-emulsion Wax	**No. 1568**	Rust-inhibiting and protective wax applied by conventional dipping, spraying, wiping, or flow-coating. Forms a dry wax coating. Is non-flammable and non-toxic.	For application on black-oxidized, phosphated, and untreated metal surfaces, as well as on painted and plated parts.
Plastic Adhesives	**Nos. 12507 and 12508**	Two modified phenolic liquid adhesives which, when properly cured, exhibit high shear and tensile strengths and exceptional resistance to water, gasoline, kerosene, and mineral oils. Designed for cementing metals, thermosetting plastics, wood, fabric, or any combination of these.	Especially useful for cementing metals and laminates; preparing metal-faced, sandwich type construction; attaching brackets and lugs to thin metal sheets; and constructing trailer walls, airplane fuselage walls, and walls of prefabricated housing.
Graphitic Alloy Steel	**No. 91140**	A graphite alloy steel containing free graphite, as well as carbides. Has improved machinability and freedom from scuffing and scoring. Can be heat-treated, with a minimum of distortion, to obtain a wide range of physical properties.	Suitable for use in such applications as engine lathe ways, spindles, pump parts, and pneumatic hammer parts.
Bearing Bronze	**Non-Gran**	Non-granular bronze with needle-like structure that has greater toughness, resiliency, and longer service life.	For use in bearings.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Cold-solvent Material	**Oakite No. 15**	Cold-solvent material for removing baking japans, paint, and similar finishes from metal surfaces without attacking the metal.	May be applied at room temperature by tank immersion or by swabbing or brushing. Useful in production stripping of rejected parts.
Metal Primer	**Ospho**	Priming compound that causes iron oxide to change to iron phosphate, an inert, hard, dark gray substance. Provides excellent bond for coating of paint.	For application directly over rusted metal surfaces.
Protective Coatings	**P-5**	A series of coatings having high resistance to moisture, acids, and alkalies. Are free from objectionable odors, non-toxic, and have good thermal stability, high resistance to abrasion and scrubbing, and good aging characteristics.	Developed for industrial use, particularly in the protection of metal, wood, and concrete.
Metal Cleaners	**Parco**	A series of metal cleaners for steel, zinc, and aluminum, including emulsion, acid, and alkaline types.	Specialized cleaners to meet varying conditions. Are formulated to make hard water suitable for cleaning; rapidly remove soil from metal surfaces and prepare them for fine, dense Bonderite coatings; and remove rust prior to painting.
Protective Coating	**Peelcote**	A vinyl-base protective coating applied by spray or dip and providing a clear transparent or a black opaque coating.	Designed to protect metal surfaces from scratches, chips, and corrosion during shipment, storage, and handling.
General-purpose Cleaner	**Pennsalt MC-1**	A dry granular material that dissolves quickly in water for general-purpose cleaning.	Applications include cleaning of walls, floors, woodwork, and windows; industrial washing machine use; steam-gun cleaning of painted or unpainted surfaces; tumble barrel cleaning; and burnishing and deburring operations.
Stainless-steel Clad Sheets	**Permaclad**	Sheets of stainless steel that are inseparably welded to a mild steel backing.	Can be subjected to a much deeper draw without annealing than stainless steel. Can be arc-welded, spot-welded, or soldered with ease and safety.
Protective Coating	**Permacote**	A transparent liquid skin readily applied by brushing, spraying, or dipping. Forms a tough transparent coating, which remains flexible and is resistant to extremes of heat or cold.	Applicable to metal, wood, leather, and fabric surfaces. For protection against corrosion and deterioration.
Casting Sealant	**Permafil**	Liquid resin that is changed to a tough, clear solid, free from voids, by the action of catalysts and heat.	For salvaging porous castings. Applied by vacuum impregnation, followed by short oven bake.
Underprimer	**Perma-Skin**	A quick drying, anti-corrosive underprimer combining metal surface treatment with high anchorage of top coats and excellent adhesion. On ferrous surfaces, corrosion is inhibited by phosphatization and action of contained pigments.	Suitable for use on such metals as cold-rolled steel, aluminum, nickel, copper, and stainless steels. Can be used as primer for practically all conventional, finishing materials, such as paints, baking enamels, lacquer, etc.
Magnetic Alloy	**Permenorm**	An alloy of nickel and iron which becomes highly magnetized when placed in an electrical field.	For use in electrical amplifiers and rectifiers.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Arc Welding Compound	**POM**	An improved arc-welding compound that supplements fluxing action of welding rod coating. It stabilizes and quiets the welding arc, prevents arc interruption, improves finish, and precludes scale on both sides of weld bead. Also prevents adhesion of weld spatter.	Is applied by brushing or spraying into the seam to be welded and on adjacent surfaces where spatter usually collects.
Prepainting Solution	**Prepaint**	A material that reacts chemically to bond with aluminum surfaces in from fifteen to sixty seconds after application. Paint or lacquer is applied immediately after this preparation with improved adhesion and uniformity of coverage.	For application to aluminum or aluminum-alloy products that are wrought, cast, die-cast, machined, forged, or extruded.
Metal Cleaner	**Quaker Formula 100**	Synthetic cleaner for the removal of mineral type soils. Provides fine grain but superficial etch on aluminum, which gives good paint adhesion.	For preparing metal surfaces for bonderizing, electroplating, and painting. Can be used to clean steel, brass, die-casting alloys, and aluminum.
Conveyor Belt	**Raynile**	High-tension fabric belt of woven rayon and nylon. In addition to high tensile strength, it has excellent transverse flexibility and minimum stretch in actual operation, and is easy to splice in the field.	For conveyor applications where belt tensions run as high as 1000 pounds per inch of width.
Protective Coating	**Redskin**	A protective liquid-plastic coating for polished or bright metal. Applied by spray, brush, or dipping. Dries quickly, forming a tough elastic film impervious to corrosive action or normal handling.	For the protection of highly finished metal surfaces.
Plastic Laminate	**RN-30**	Unwoven cotton-fiber laminated plastic with improved mechanical strength, machinability, and finish. Its strength is uniform in all directions.	For use in making gears, cams, pinions, bearings, and similar industrial products. Particularly suitable for fine-tooth gears.
Contact Cleaning Compound	**Rotol**	A liquid compound that cleans all forms of electrical contacts. Eliminates need to use sandpaper or other forms of abrasive for cleaning purposes.	Can be applied to surfaces of commutators, slip rings, and contact tracks of motors, controllers, starters, regulators, and other electrical equipment.
Primer	**Rust-O-Primer**	Combination chemical pre-treatment and primer for metal that provides a hard foundation for any type of paint.	Can be applied over wet or dry and clean or rusted metal, including steel, aluminum, and galvanized iron.
Bar Steel	**Ry-Ax**	An improved, heat-treated, carbon-manganese, hot-rolled bar steel with greater tensile srength, better machining qualities, and a higher fatigue limit.	Particularly recommended for special heavy-duty shafting such as is used in cranes, armatures, machine tools, and coal-cutting machines.
Alloy Steel	**Rycut**	Develops hardness comparable to SAE 4150 steel combined with free-machining properties, longer tool life, and less grinding after hardening.	Makes possible a saving of 25 to 50 per cent in machining time compared with standard alloy steels.
Enamel Stripper	**S-45**	A slightly viscous liquid that can be brushed, sprayed, or applied by dipping. Contains an evaporating retardant to prolong stripping action. Causes enamel to wrinkle, so that it can be readily brushed, wiped or scraped off.	Recommended for large parts that cannot be immersed in a stripping solution. Acts rapidly on most synthetic enamels, as well as certain nitro-cellulose coatings. Not satisfactory for linseed-oil paints, phenol-formaldehyde enamels, or vinyl type coatings.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Tape Type Adhesive Film	**Scotch-Weld**	Unsupported film of pure adhesive that provides a metal-to-metal bond resistant to shear tests up to 3500 pounds per square inch.	Used under heat and pressure to bind metal to metal, fiber, wood, and plastic surfaces.
Casting Sealer	**Sealant P.E. No. 1**	Leaves no gummy residue, and surfaces, ducts, pockets, or machined areas show no visible sign of treatment. Pressure-tightness can be obtained with only one impregnation.	Intended primarily for impregnation of low-density metals, such as aluminum and magnesium alloys. Also can be used for bronze, steel, and gray iron castings.
Plastics	**Selectron**	A series of highly versatile plastics developed for wartime radar and aircraft applications, now available for a wide range of peacetime uses. Within limits, the resins are being made to specifications individually designed to meet customers' particular requirements.	Applications include laminating, impregnating, casting, molding, and use as adhesives.
Protective Oil	**Special Protective Oil**	A semi-permanent rust-preventive oil of low viscosity, which imparts a film to ferrous surfaces that resists moisture, humidity, perspiration, and acid fumes. Disperses water on metal surfaces.	For surface protection of ferrous parts.
Thermal Barrier Materials	**Stabond FR-8 Stabond FR-10**	Sealing compounds that are capable of withstanding temperatures as high as 2800 degrees F.	Can be applied by trowel, brush, or extrusion gun to electrical junction boxes, heat exchanger couplings, etc. Useful for steam-pipe lagging and hot-air ducts, and also as an abrasion-resistant coating for electrical systems.
Sub-zero Rubber Compound	**Stalwart**	Rubber compound with Butaprene base that withstands prolonged exposure to low temperatures without loss of flexibility.	Resists fats, dilute acids, alkalies, petroleum products, hydrocarbons, and solvents. Can be extruded, machined, punched, and molded.
Heavy-duty Grease	**Sta-Put 18H-2**	Aluminum-soda grease with an exceptionally high melting point. Will not separate in automatic or centralized lubrication systems.	Especially recommended for large heavily loaded presses, contracting, mining, and dredging equipment, hoists, cranes, etc.
Corrosion Inhibitor	**Steelyfe 11**	A thin, dark liquid having a flash point of about 105 degrees F. Upon evaporation, it leaves a soft, transparent coating which has high corrosion-preventive properties. Is readily removed by wiping or by the use of degreasers.	Applied to steel and other ferrous metals by dipping, brushing, or spraying.
Stripper	**Stripper S-17 Stripper S-19**	Room-temperature strippers for synthetic enamels.	Particularly suitable for removing heavy coatings of enamels that accumulate on work-holders and hooks.
Soldering Alloys	**Super Solder**	A series of soldering and brazing alloys in paste form containing a cleaning agent, flux, tinning agent, and solder. After application, only heat is necessary to establish strong joints.	Can be applied with spatula, brush, or from a collapsible tube. Adaptable for semi- and fully-automatic methods of application.
Hard-surfacing Powder	**Surfaceweld A**	Used for depositing a thin chromium-carbide type of hard surface that is highly resistant to abrasive wear and corrosion. When mixed with water, it forms a paste that adheres to flat or curved surfaces.	Applied by means of alternating-current arc with single carbon electrode, with twin carbon arc, or with direct-current carbon electrode negative. Particularly applicable to thin work or in cases where small alternating-current welders are used.

Review of Some Recently Developed Materials—Continued

MATERIAL	TRADE NAME	PROPERTIES	APPLICATIONS
Concrete Repair Material	**Tampatch**	Repair material for use on concrete floors. Withstands heavy traffic loads and sets quickly.	Applicable to broken or rough interior or exterior concrete surfaces.
Packaging Compound	**Thermo-dip N S**	A low-cost, hot-melt compound that is transparent and pale amber in color. It is readily removed by stripping; can be used repeatedly; and maintains its flexibility over extended periods.	For protecting machine tools, gears, and various metal parts from corrosion, abrasion, and the hazards of shipping and handling.
Spray-booth Compound	**Triad PRD**	A light-colored, semi liquid material applied to spray-booth walls with brush or spray gun. Forms a continuous white coating to which paint overspray adheres. Is readily scraped off without previous soaking or can be easily removed by flushing with either hot or cold water.	Can be used for walls of either wet or dry spray booths, but is especially advantageous for use on dry booth walls.
Solder	**Tri-Core-Leakpruf**	A solder with a triple core of synthetic acid flux that is more active but less corrosive than the usual acid fluxes.	For use in soldering all metals with the exception of aluminum and magnesium.
Free-machining Steel	**USS MX**	Provides longer tool life, greatly improved surface finish, and up to 20 per cent increase in machinability compared with standard Bessemer bar stock.	For use in automatic screw machine operations.
Carburizing Steels	**USS SuperKore**	A series of four improved carburizing steels having a hardenability equal to or greater than more highly alloyed grades in common use. They also maintain high core strength and develop the toughness necessary for heavy-duty applications; have improved carburizing characteristics; are easier to anneal; and have increased machinability.	Suitable where deep-hardening steels that can be easily machined into gears, shafts, and pinions for equipment subject to heavy-duty service are required.
Thermo-plastic Material	**Versalite**	A thermoplastic material that is tough, light, and easy to form into compound or irregular shapes. Can be formed with a solid color throughout and with a dull, satin gloss, or embossed finish. Will not chip or warp, and is highly resistant to gasoline, oils, and most commercial cleaners.	Possible applications include radio cases and parts for boats, automobiles, buses, airplanes, and trains.
Refractory Coating	**Vitroseal**	A refractory coating that prevents spalling action, resists heat penetration, and decreases carbon slag and clinker adherence. Forms a semi-glazed, protective monolithic wall of from 8.5 to 9 Mohs hardness scale, and is impervious to heat up to 3390 degrees F. Withstands effects of flame impingement and abrasion.	Applied over firebrick in fireboxes, furnaces, and crucibles by brush or spray.
Lubricant	**Way Lubricant D**	Will not squeeze or press out either when machine is in motion or standing still. Will not corrode steel and copper and will not plug filters.	For use on all kinds of machine ways—hardened steel, chilled cast iron, or laminates.
Insulating Tape	**Wrap-Rax**	Orange-colored synthetic-resin tape that chemically resists all cleaning, pickling and plating solutions commonly used.	Is effective as a "stop-off" in hard chromium and other plating solutions, and prevents disintegration of plating racks.
Anti-corrosive Process	**Zincilate**	A process for coating ferrous metals which is said to provide twenty years' protection against all common types of corrosive action. Only one coat is needed, and this has high abrasion resistance.	Has been used successfully on pipe lines, on the interiors and exteriors of water and gasoline tanks, on bridges, machine parts, and marine installations.

Modern Applications of Precision Wood Bearings

By H. CLAY MELLOR
Arguto Oilless Bearing Co.
Philadelphia, Pa.

OILLESS wood bearings, like so many other products of wood, are sometimes thought of as antiquated carry-overs from a past era. This is an erroneous idea, as the fact is that the advantages inherent in wood bearings are being utilized by industry today for many applications where other materials fail or give lower standards of service. The purpose of this article is to point out to design and production engineers the basic characteristics of oilless wood bearings and how they can be used to best advantage.

High quality wood bearings are made of carefully selected hard wood, chosen so that there will be no breakdown in the vascular tissue through wear. Specifications for this uniformly close-grained wood must be adhered to rigidly or, like a poor casting in metal, further work and resultant service life will prove to be a poor investment. Choice blocks of wood are carefully treated and seasoned a minimum of four years before the next step—impregnation—is performed.

The seasoned wood is impregnated with a specially formulated non-oxidizing lubricant. Then additional seasoning and treating take place to impart dimensional stability. The result is a material that is 60 per cent hard wood and 40 per cent entrained lubricant. The properties of the lubricant are a critical factor in the quality of the bearing, for it must possess combined antifriction and non-oxidizing properties. The wood acts as a reservoir for the lubricant.

The large impregnated blocks are cut into blanks of any desired size for subsequent shaping on precision machine tools. Since wood is readily worked, practically any size and shape can be produced economically in either large or small quantities. Threading, notching, beveling, internal working, and external shaping are readily accomplished to any desired specification. The normal tolerance maintained on finished bearings, bushings, hubs, etc., is + 0.0015 inch, but closer tolerances can be held where required.

Oilless wood bearings are general-purpose, light-duty bearings that have wide application. When used in the form of sleeve bearings, the heat generated by friction as the shaft rotates in the bearing causes a fine lubricating film to come to the surface of the bearing, which separates the shaft and bearing surfaces and reduces the friction. These conditions automat-

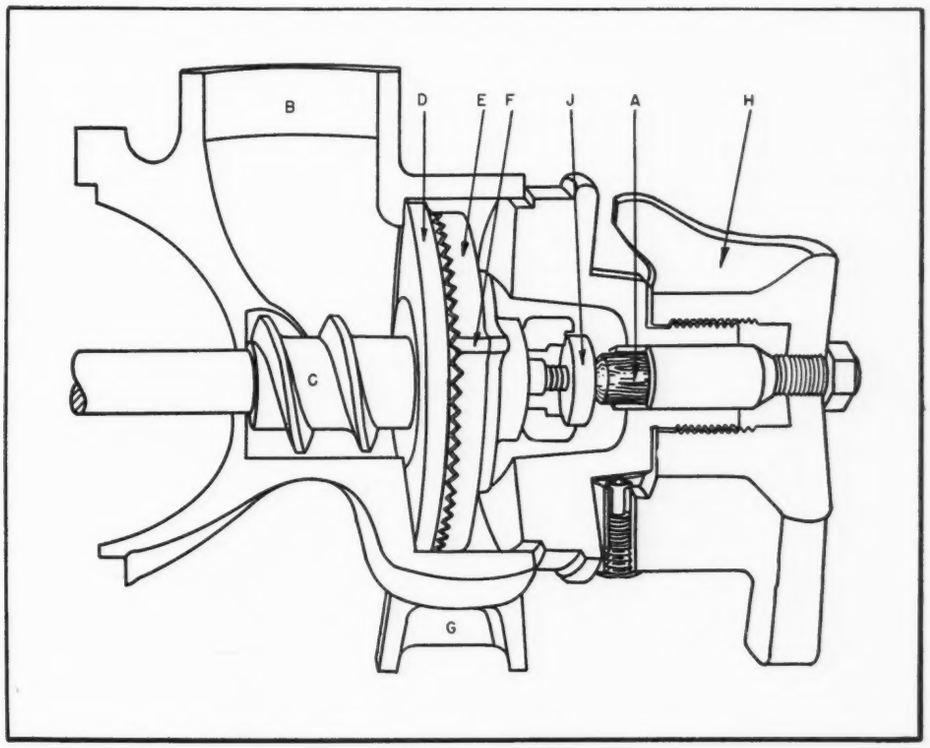


Fig. 1. Coffee grinder in which a self-lubricating wood plug (A) is employed as a thrust bearing. This design provides sufficient lubrication and, at the same time, prevents lubricant from contaminating the coffee

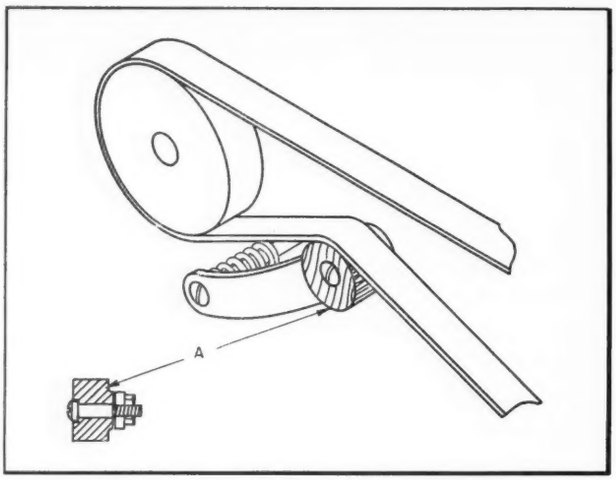


Fig. 2. An oilless wood idler pulley (A) is used to maintain proper tension on the driving belt of an office dictating machine, thus minimizing wear and noise by lubricating the shaft about which it rotates

ically reach a balance wherein the resulting temperature is just sufficient to maintain the proper lubricating film for the speed and load carried by the bearing. This balance will be reached over a wide range of speed and load values.

Operated within the allowable limits, the bearing will maintain its lubricating film indefinitely. One Arguto oilless bearing has been operating thirty-one years without attention. This is possible because the wood reabsorbs and stores the lubricant during the periods when the shaft is not rotating in the bearing.

Typical applications of oilless wood bearings are as follows: (1) Where access to bearings for lubrication purposes is difficult or impossible, such as in speed reducers on remote control valves, foot-shaft bearings on mine coal loaders, conveyor belt mechanisms, etc.; (2) where excessive lubrication would spoil the product, such as in textile, printing, and food processing equipment; (3) where insufficient lubrication due to lack of care may cause breakdowns, such as in office equipment, laboratory centrifuges, electrical appliances, wheelbarrows, etc.; (4) where a moving metal-to-metal contact may be undesirable or dangerous, as on equipment for manufacturing explosives; (5) where liquids surrounding the bearing tend to wash away other types of lubricants, as in sump pumps, mixers, and outboard struts on boats; (6) where good dielectric properties are required of a bearing for radar antennas and spot-welding equipment; (7) where abrasive material would greatly reduce the life of metal bearings, such as on lens-grinding spindles and foundry sand conveyors.

The following examples describe applications where self-lubricating wood parts have solved unusual problems:

A coffee grinder, Fig. 1, manufactured by the American Duplex Co., Inc., Louisville, Ky., includes an Arguto wood plug *A*, which serves as a thrust bearing. Coffee beans are fed into the top of the machine at *B*, and are picked up and carried by revolving screw *C* to the grinding area. They enter through the center of stationary burr *D*, and are ground to the desired grade between the stationary burr and the rotating burr *E*. Sweep *F* on the revolving burr cleans out the grinder head and conveys ground coffee through spout *G* at the bottom of the machine. Various grades of ground coffee are obtained by revolving index-plate *H*, which changes the amount of opening between the two burrs.

The oilless wood plug *A* is rounded on one end to mate with the concave face on disk *J*. This disk rotates with burr *E*, so that the oilless plug acts as a thrust bearing and maintains a uniform grind. The proximity of this bearing surface to the coffee makes it imperative that no lubricant drip from the bearing, and yet there must be sufficient lubrication to reduce friction and prevent wear. These conditions are fulfilled by designing this part of wood.

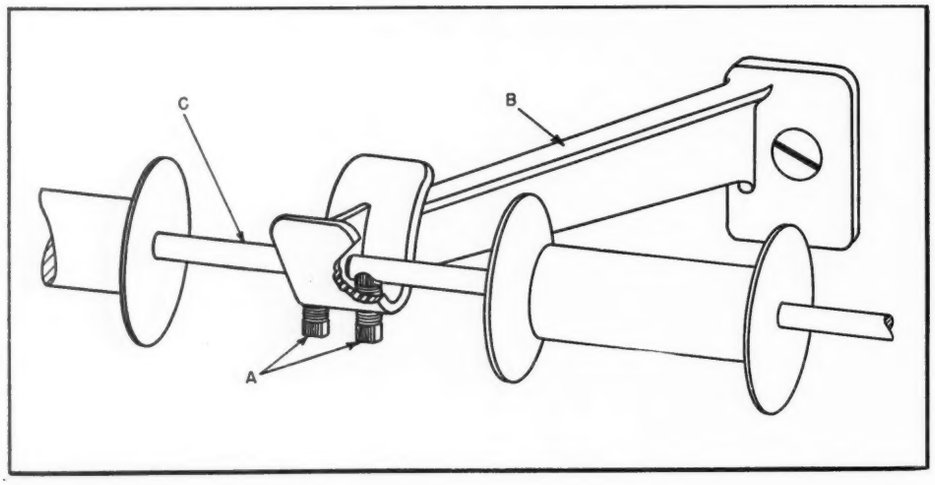


Fig. 3. In converting textile machines for higher speed operation, threaded plugs (A) of oilless wood were screwed into cast-iron hanger (B) to support bobbin spindle (C). Previously, the spindle rotated directly on the hanger

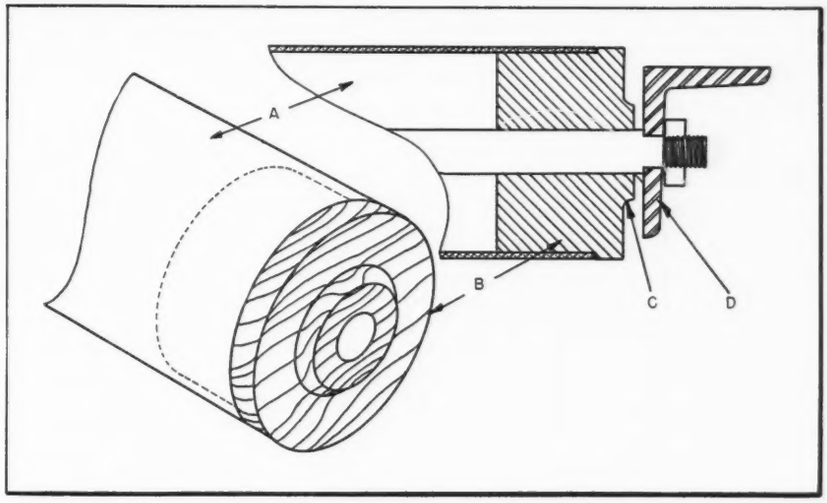


Fig. 4. Noise is minimized and maintenance is practically eliminated by the use of self-lubricating wood flange bearings (B) on a roller conveyor. The bearings are pressed into ends of tube (A)

An idler pulley *A*, Fig. 2, made from oilless wood is used to maintain proper tension on the driving belt of an office dictating machine. The periphery of the idler pulley remains clean, while the rubbing action in the bore of the pulley produces a fine film of oil which lubricates the shaft on which it rotates, thus minimizing wear and noise.

Threaded plugs *A* of oilless wood are screwed into a cast-iron hanger *B* to support bobbin spindle *C* on a textile machine, as illustrated in Fig. 3. This was a war-time measure taken to increase the output of old machines when new equipment was not available. Originally the machine was designed for slow speeds, with the cold-rolled steel bobbin spindle rotating in direct contact with the cast-iron bracket. When the machines were converted for the use of higher speeds, the spindles and brackets showed excessive wear. To correct this, the brackets were drilled and tapped, and threaded wood plugs were screwed into place.

The upper ends of the plugs are made concave to match the spindle, and the lower ends are machined flat on two sides so that the height of the spindle can be easily adjusted with a small wrench. Small amounts of wear can be compensated for by turning the plug. Bracket and spindle wear was reduced to a minimum, and a smoother running bobbin improved the quality of the yarn produced.

A self-lubricating wood flange bearing for a conveyor roller is shown in Fig. 4. The roller can be used on either the feed or the return side of a belt conveyor or on a gravity roller conveyor. The simplicity of this installation is evident. Tubing *A* is faced to length, and a wood flange bearing *B* is pressed into both ends of the tube. A press fit is all that is required to hold the bearing in place.

The flange diameter of the bearing has the same outside diameter as the tubing, and provides a shoulder against which the tubing is positioned. Boss *C* on the outer face of the bearing takes end thrust loads and provides a reduced surface area to minimize friction between the bearing and frame member *D*. This type of conveyor installation is particularly advantageous

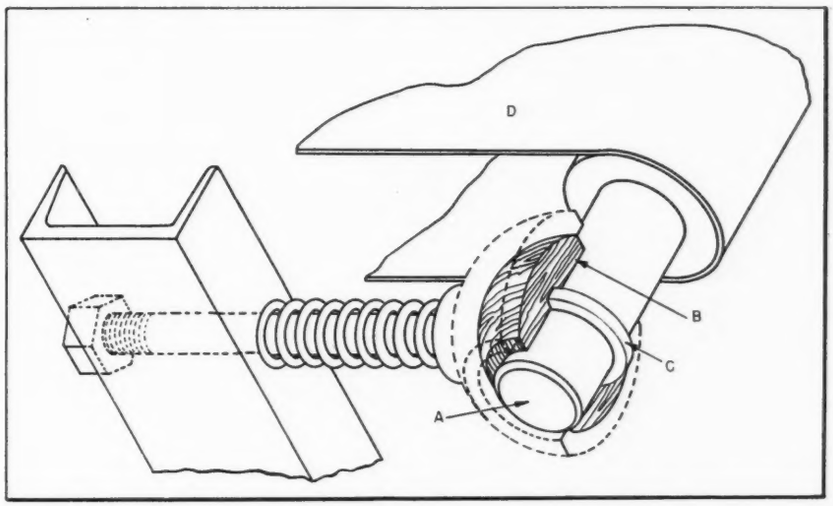


Fig. 5. Special oilless wood half-bearings (B) are employed to support both ends of a foot-shaft (A). Conveyor (D) handles dynamite, requiring the elimination of overheating or sparking

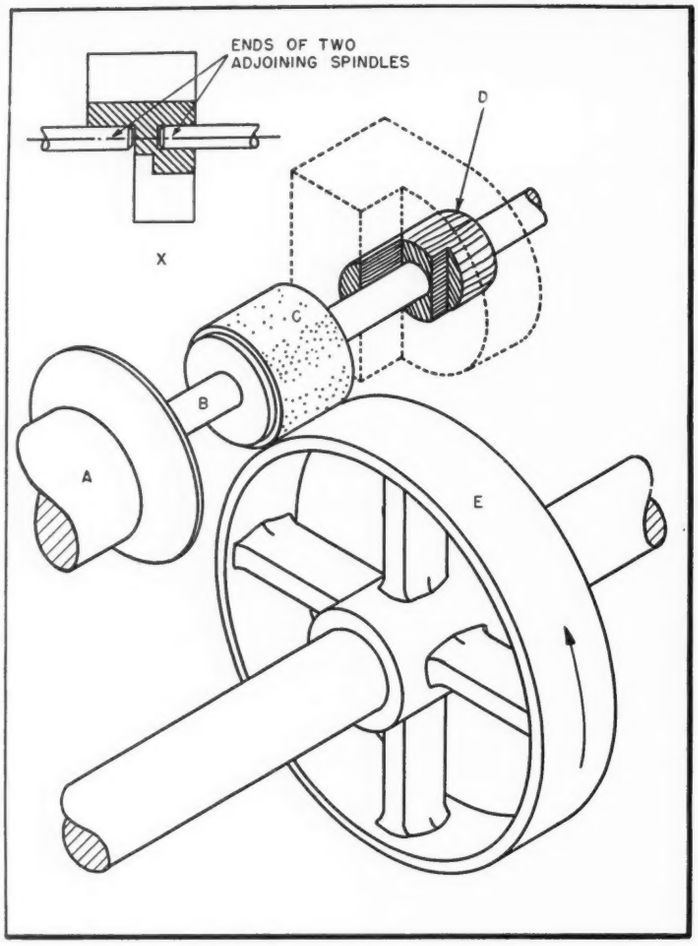


Fig. 6. A special oilless wood bearing (D) permits quick replacement of bobbin (A) when it becomes filled, and prevents soiling of the yarn while the machine is in operation or when changing bobbins

where noise is objectionable and minimum maintenance is important. It is also used extensively where metal bearings would rust because of chemical fumes. In the latter type of application, stainless steel and aluminum are often used for the other components of the conveyor.

Another use of an oilless wood bearing in a conveyor is illustrated in Fig. 5. Foot-shaft *A* is supported at both ends by a special half-bearing *B* having a spherical outside diameter and a groove in its bore which engages the ring *C* on the shaft. The spherical diameter makes the bearing self-aligning, and the mating groove and ring permit the bearing to take thrust loads. This foot-shaft operates below the floor level, where oiling would be difficult. Conveyor *D* handles dynamite, and every possibility of overheating or sparking had to be eliminated.

A special design employed to simplify a bearing problem is illustrated in Fig. 6. The mechanism is part of a redraw machine on which thread is wound on bobbins that frequently become filled and must be replaced by empty bobbins. The empty bobbin *A* is placed on a spindle *B* which has a cork-faced roll *C* attached to it. One end of the spindle engages a recess in one side of oilless bearing *D*, and the other end contacts the flat surface on the opposite side of the next ad-

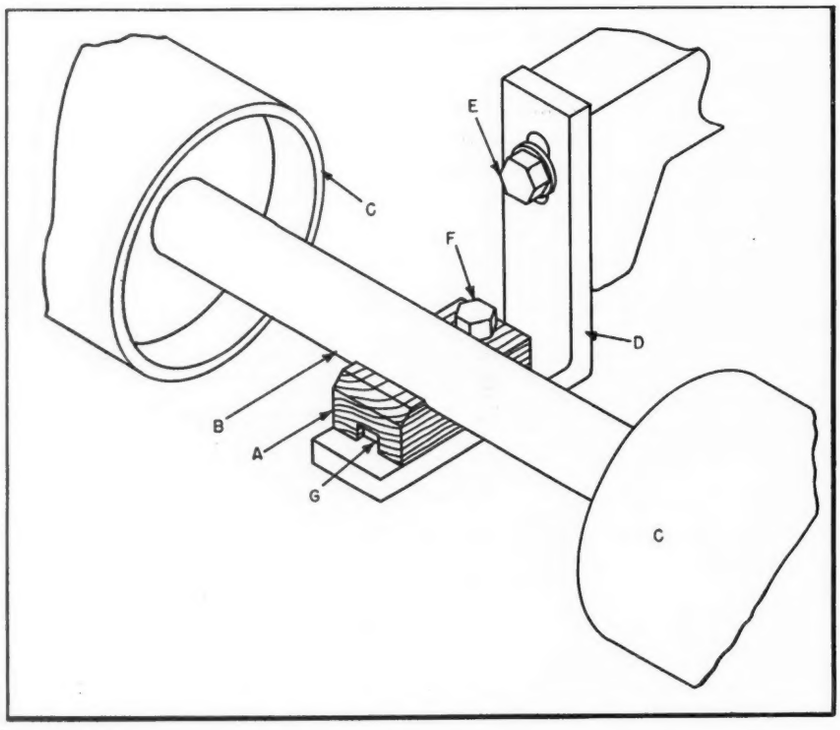


Fig. 7. Sizing solution is applied to nylon threads as they pass through a winding machine by rollers (C). The danger of contaminating the sizing solution with oil is eliminated by using the self-lubricating wood bearing (A)

joining bearing, as seen at *X*. The driving pulley *E*, rotating in a counter-clockwise direction, revolves the cork-faced roll, which is held in contact with the pulley by gravity and by the flat surface on one end of the bearing.

This design enables the bobbins to be quickly changed, and at the same time maintains a clean machine, so that the yarn does not become soiled during the changing of the bobbins or the operation of the machine.

The center support bearing *A*, Fig. 7, for sizing-roll shaft *B* on a winding machine is made from self-lubricating wood. As the rollers *C* rotate, they pick up a sizing solution from a trough and deposit it on nylon threads which are in contact with the moistened rollers. The position of the shaft and the rollers must be adjustable, so that the amount of sizing deposited on the threads can be varied. Vertical adjustment is accomplished by loosening nut *E* on supporting bracket *D* and moving the bracket to the desired position. Horizontal adjustment can be effected by loosening nut *F* and sliding the bearing block *A* on projection *G* of the bracket to the required position. The self-contained lubrication in the bearing block minimizes the possibility of contaminating the sizing solution with oil.

The use of self-lubricating wood for bearings in the knee joint of an artificial

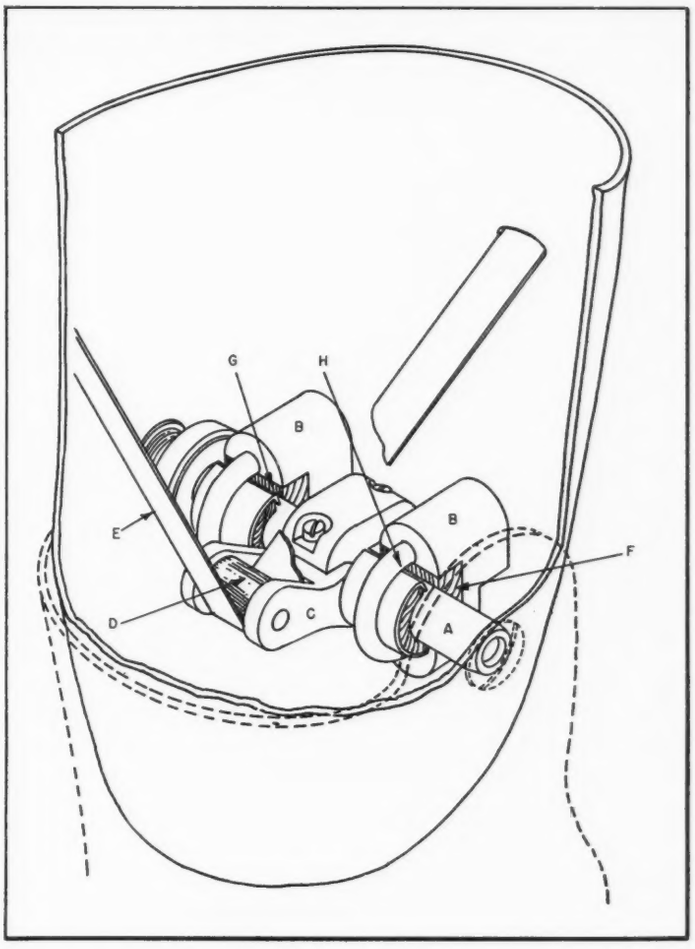


Fig. 8. The use of self-lubricating wood bearing blocks (F) and (G) and bearing roller (D) results in quiet operation and requires no lubrication in the knee joint for an artificial leg here illustrated

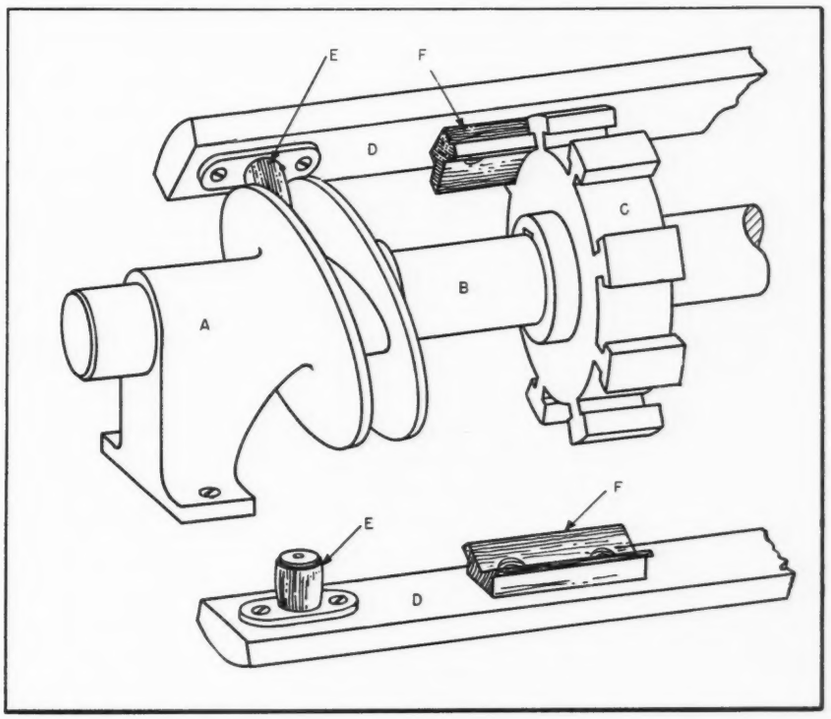


Fig. 9. Cam followers (E) and slide bearing blocks (F) are made from self-lubricating wood because lubrication of these parts would be difficult, and excessive lubrication might ruin the material being processed

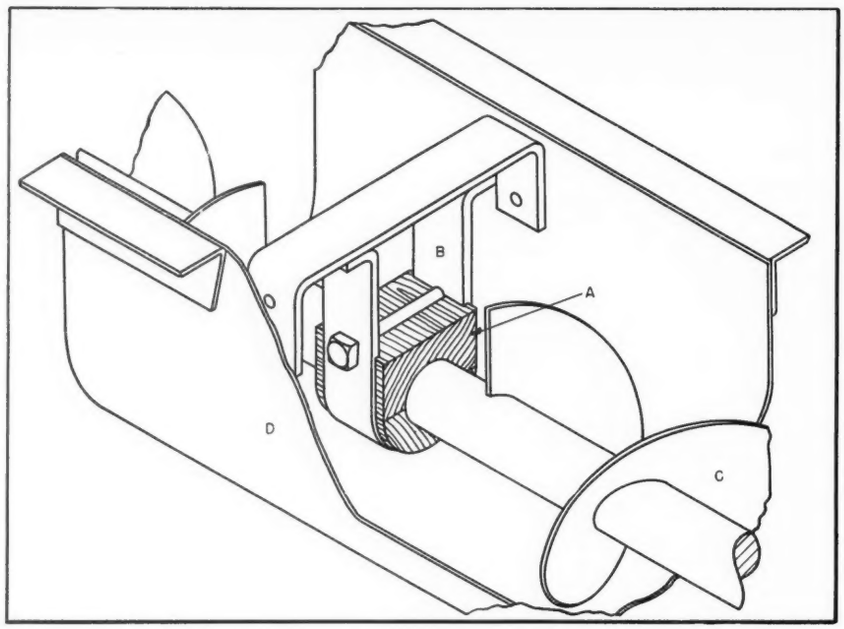


Fig. 10. Materials that cannot be allowed to become contaminated by oil or grease can be safely handled in screw conveyor (C) by using an oilless wood bearing (A)

leg is illustrated in Fig. 8. Shaft *A* is fastened to the lower part of the leg and moves with it, while the aluminum castings *B* are fastened to the upper part of the leg. Arms *C* are attached to shaft *A*, and when the knee is bent, arms *C*, with the wood bearing roller *D* between them, swing downward. This action causes bearing *D* to roll over tape *E*. The tape extends up the front and back of the leg and is attached to a support around the waist. The upper part of the tape is elastic so that when the weight is removed from the leg, the tape pulls arms *C* back into their original positions, and the leg is straightened.

The ease of rotation of shaft *A* in the bearing blocks *F* and *G* is controlled by tightening nuts on the end of U-bolts *H*. These nuts are hidden by castings *B* in the sketch. This adjustment of friction in the self-lubricating wood bearing blocks is made to suit the individual's weight and length of leg. Once adjusted, the friction remains constant and the knee joint is silent and requires no lubrication.

The design of part of a cloth stretching machine manufactured by the Curtis & Marble Machine Co. is seen in Fig. 9. This machine contains two eccentric ring castings, one of which

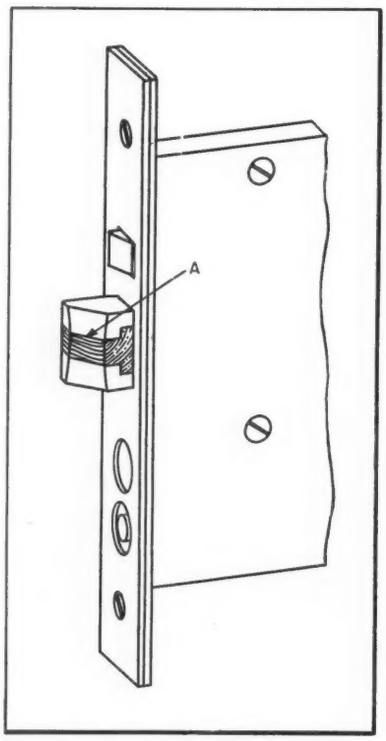
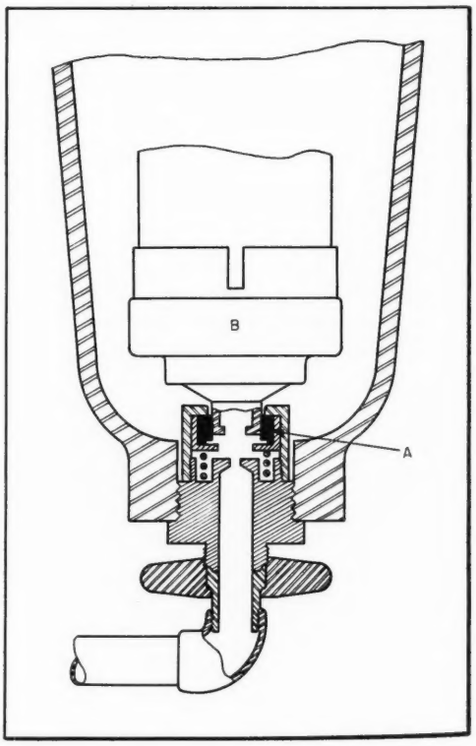


Fig. 11. (Left) An insert (A) of oilless wood provides sufficient lubrication to prevent wear and insure easy operation of this pin-tumbler lock without staining anything

Fig. 12. (Right) Self-lubricating wood is employed for the guide bushing (A) of this centrifuge. Bowl (B) operates at a speed of 17,000 R.P.M.



is shown at *A*. Shaft *B* is supported between these two castings, and is free to rotate in them. Four heads, one of which is shown at *C*, are keyed to the shaft. Eight wood slots *D* are mounted at both ends of the cloth stretching roll, and each set of eight slats is held in place by two heads and one eccentric ring.

As shaft *B* rotates, cam followers *E* slide each slat in and out on heads *C*. The slats are held in position by slide bearing blocks *F* that mate with slots in the heads. Eccentric rings *A* are designed so that the slats at both ends of the cloth stretching roll pull slowly outward, to a fully extended position, as the material being stretched is about to leave the roll.

This machine is generally used to stretch cloth, but a secondary and more interesting application is for stretching the transparent film used between layers of glass to make safety glass. In both these applications, lubrication of the cam followers *E* or the slide blocks *F* would be difficult. Excessive lubrication or metal chips dropping from the roll to the film would be costly. This problem was solved by using self-lubricating wood for these parts.

The use of a two-piece Arguto bearing *A* in the hanger *B* of a screw conveyor *C* is illustrated in Fig. 10. This application of an oilless wood bearing of special shape eliminates the lubrication problem, and more important, insures that the material being conveyed through trough *D* will not become contaminated by oil or grease. This type of bearing is used in equipment employed for handling flour, feed, sugar, magnesium carbonate, or other products whose purity standards must be closely guarded.

A pin-tumbler lock manufactured by Yale & Towne Mfg. Co. is seen in Fig. 11. The insert *A* of oilless wood makes a self-lubricating latch-bolt, which gives the head, guides, and striker a slight film of lubricant at each operation of the latch-bolt. This lubrication is sufficient to prevent wear and insure easy operation of the bolt without staining anything.

Guide bushing *A* in the centrifuge seen in Fig. 12 is made from self-lubricating wood. The weight of bowl *B* and its contents is suspended from a ball bearing (not shown) by means of a flexible spindle above the bowl. The guide bushing is flexibly mounted at the lower end of the frame, and carries practically no load. The bushing acts as a guide and requires no maintenance or lubrication. The bowl operates at a speed of 17,000 R.P.M.

Semi-Annual Meeting of Tool Engineers

THE program for the seventeenth semi-annual meeting of the American Society of Tool Engineers, which will be held at the Mount Royal Hotel, Montreal, Canada, October 27 to 29, inclusive, provides for nine technical sessions. These sessions will deal primarily with methods by which tool engineers can reduce tooling and manufacturing costs.

Typical papers to be presented are as follows: "Mold Die Hobbing," by Islyn Thomas, president, Thomas Mfg. Corporation, and Edmund W. Spitzig, hobbing supervisor, Newark Die Co.; "Mold Die Finishing," by M. C. Overholt, general superintendent, Peerless Engineering, Ltd.; "Application of Standard Tool Parts to Cut Costs," by W. Arthur Thomas, superintendent of tool engineering, Ford Motor Co. of Canada, Ltd.; "Surface Finish Control and the Making of Master Standards," by Arthur F. Underwood and Roy P. Trowbridge, General Motors Research Laboratories, Mechanical Engineering Division; "Calibration of Master Roughness Standards and Their Use," by Dr. Clayton R. Lewis, staff research engineer, Chrysler Corporation; "Low Melting Point Alloy for Tool and Die Work," by Carleton H. Smith, branch manager, Canada Metal Co., Ltd.; "Special-Purpose Machines from Standard Units," by Edgar L. Barker, president, Modern Tool Works, Ltd.; "Milling Hot Work-Pieces," by J. R. Roubik, of Kearney & Trecker Corporation and Marquette University; "Hot Spot Machining," by Sam Tour, chairman of the board, Sam Tour & Co., Inc.; and "Statistical Quality Control," by John K. MacKeigan, chief inspector, Tire Division, Dunlop Tire & Rubber Goods Co., Ltd.

A symposium on factors relating to lower costs is scheduled for the afternoon of October 28. Papers at that session will be "Economics of Limited Production," by E. P. Blanchard, general sales manager, The Bullard Co.; "Tools and Materials for Limited Production," by J. B. Savits, methods manager, Pneumatic Scale Corporation, Ltd.; and "Quality Control of Limited Production," by C. D. Wright, chief engineer, Reliable Toy Co., Ltd.

Numerous plant visits have been scheduled to permit the engineers to inspect methods by which Canadian industry has raised itself from eighth to fourth place in the world's output.

Plastic Product and Mold Design

Part Tolerances, Mold Steels, and Principles of Plastic Product Design Recommended by the Westinghouse Electric Corporation — Second of Three Articles on Precision Molds for Molding Thermosetting Plastic Materials

By JOHN J. JOHNESCU, Assistant Superintendent
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Westinghouse Electric Corporation, East Pittsburgh, Pa.

THE tolerances obtainable on plastic parts are governed by such a variety of factors that it is often impossible even for an engineer with considerable experience in plastic mold design to predict accurately the dimensions that can be held. Designers frequently specify tolerances that are closer than necessary, with the results that both mold and product costs are higher than necessary. While tolerances of ± 0.003 inch are obtainable on some parts, such close tolerances should be avoided when possible.

The tolerances shown in Table 2 for various mold dimensions are used as a general guide by designers at the Westinghouse plant. Obviously, they cannot be applied in all cases. Consultation between the product designer, the mold designer, the molder, and others concerned with the production of the assembled part is the best method of establishing tolerances.

When the tolerances have been established, the mold designer must allow for shrinkage of the material in the mold, variations in machining or hobbing the mold, and distortion of the mold due to heat-treatment.

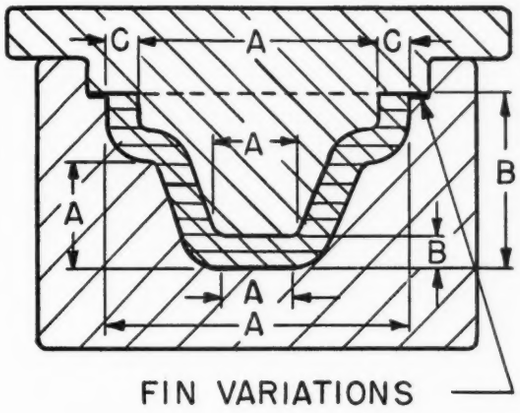
Materials Used in Making Molds

The material of which the mold is made directly affects the tolerances that can be held. The primary consideration in selecting a steel for this purpose is to obtain (1) a steel that will have a minimum amount of distortion when heat-treated; and (2) a steel that will resist breakage in spite of the high stress concentra-

Table 1. Steels Used in Making Plastic Molds, and Their Heat-Treatments

Application	Type of Steel	Heat-Treatment
Machined Molds	Modified S A E No. 3335	Heat to approximately 1650 degrees F. in a controlled atmosphere of dissociated ammonia and methane gas. Hold at heat for about one hour per inch of section. Cool in furnace to room temperature. Temper at 350 degrees F. for one hour per inch of section. This treatment gives a surface hardness of from 55 to 60 Rockwell C, a core hardness of 40 Rockwell C, and a depth of case of about 0.020 inch.
Hobbed Molds	Air-Hardening (Composition: Carbon, 0.10 per cent max.; manganese, 0.30 per cent; chromium, 5.00 per cent; molybdenum, 1.00 per cent; vanadium, 0.40 per cent; silicon, 0.10 per cent; sulphur, 0.025 per cent max.; and phosphorus, 0.025 per cent max.)	Heat to approximately 1750 degrees F. in a controlled atmosphere of dissociated ammonia and 3 per cent methane gas. Hold at heat for three hours for each 1/32 inch depth of case desired. (The case depth should never exceed 3/32 inch or 1/4 of the thickness of the thinnest section in the mold.) Cool in furnace to room temperature. Temper at 660 degrees F. for one hour per inch of cross-section. This treatment gives a surface hardness of 55 to 60 Rockwell C and a core hardness of 25 Rockwell C.
Mounting Plates	S A E 1035 to 1045	
Steam Plates	S A E 1035 to 1045	
Stripper Pins	Nitriding steel similar to Nitralloy G	
Guide Pins	N.E. No. 8620	

Table 2. Tolerances for Compression and Transfer Molded Parts



FIN VARIATIONS

Compression and Transfer Molded Parts

Class (A) dimensions are determined by fixed mold parts, and are affected by the tolerances on the mold, by variations in shrinkage during molding, and by wear of mold

Class A Dimen., Inch.	Commercial, Inches	Close, Inches
Up to 1/2	± 0.005	± 0.002
Above 1/2 to 1.0..	± 0.006	± 0.003
Above 1.0 to 2.0..	± 0.008	± 0.004
Above 2.0 to 3.0..	± 0.010	± 0.006
Above 3.0 to 4.0..	± 0.0115	± 0.008
Above 4.0 to 5.0..	± 0.0125	± 0.010
Above 5.0	± 0.0025 × dimension	± 0.002 × dimension

Compression Molded Parts

Class (B) dimensions are determined by mating mold parts, and are affected by variations in pin thickness, as well as by the factors that affect Class (A) dimensions

Moldability	Class B Dimen., Inch.	Commercial, Inches	Close, Inches
Good (Phenolic or urea resin with wood flour, cotton fiber, or cellulose fiber fillers)	Up to 1.0	± 0.008	± 0.005
	Above 1.0	± 0.008 + 0.003 × dimension	± 0.005 + 0.002 × dimension
Fair (Phenolic resin with wood pulp board, mica, cotton fabric, or asbestos fiber fillers)	Up to 1.0	± 0.015	± 0.010
	Above 1.0	± 0.015 + 0.003 × dimension	± 0.010 + 0.003 × dimension

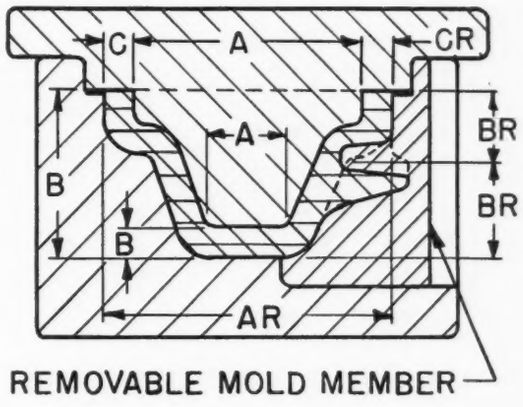
Transfer Molded Parts

Class B Dimen., Inch.	Commercial, Inches	Close, Inches
Up to 1.0	± 0.006	± 0.004
Above 1.0	± 0.006 + 0.001 × dimension	± 0.004 + 0.001 × dimension

Compression and Transfer Molded Parts

Class (C) dimensions are determined by mating mold parts, and are affected by the wear of gin pins and by the factors mentioned under Class (A) dimensions

Class C Dimen., Inch.	Commercial, Inches	Close, Inches
Up to 1.0	± 0 008	± 0.005
Above 1.0	± 0.006 + 0.002 × dimension	± 0.003 + 0.002 × dimension



REMOVABLE MOLD MEMBER

Compression and Transfer Molded Parts

Class (AR) dimensions are determined by a removable mold member, and are affected by dust, wear, misalignment, and by the factors affecting Class (A) dimensions

Class AR Dimen., Inch.	Commercial, Inches	Close, Inches
Up to 1/2	± 0.017	± 0.010
Above 1/2 to 1.0..	± 0.018	± 0.011
Above 1.0 to 2.0..	± 0.020	± 0 012
Above 2.0 to 3.0..	± 0.022	± 0.014
Above 3.0 to 4.0..	± 0.024	± 0.016
Above 4.0 to 5.0..	± 0.025	± 0.018
Above 5.0	± 0.012 + 0.0025 × dimen.	± 0.008 + 0.002 × dimen.

Compression Molded Parts

Class (BR) dimensions are determined by a removable mold member, and are affected by dust, wear, misalignment, and by the factors affecting Class (B) dimensions

Moldability	Class BR Dimen., Inch.	Commercial, Inches	Close, Inches
Good (Phenolic or urea resin with wood flour, cotton fiber, or cellulose fiber fillers)	Up to 1.0	± 0.018	± 0.013
	Above 1.0	± 0.018 + 0.003 × dimension	± 0.013 + 0.002 × dimension
Fair (Phenolic resin with wood pulp board, mica, cotton fabric, or asbestos fiber fillers)	Up to 1.0	± 0.025	± 0.018
	Above 1.0	± 0 025 + 0.003 × dimension	± 0.018 + 0.003 × dimension

Transfer Molded Parts

Class BR Dimen., Inch.	Commercial, Inches	Close, Inches
Up to 1.0	± 0.016	± 0.012
Above 1.0	± 0.016 + 0.001 × dimension	± 0.012 + 0.001 × dimension

Compression and Transfer Molded Parts

Class (CR) dimensions are determined by a removable mold member, and are affected by dust, wear, misalignment, and by the factors affecting Class (B) dimensions

Class CR Dimen., Inch.	Commercial, Inches	Close, Inches
Up to 1.0	± 0.020	± 0.013
Above 1.0	± 0.018 + 0.002 × dimension	± 0.011 + 0.002 × dimension

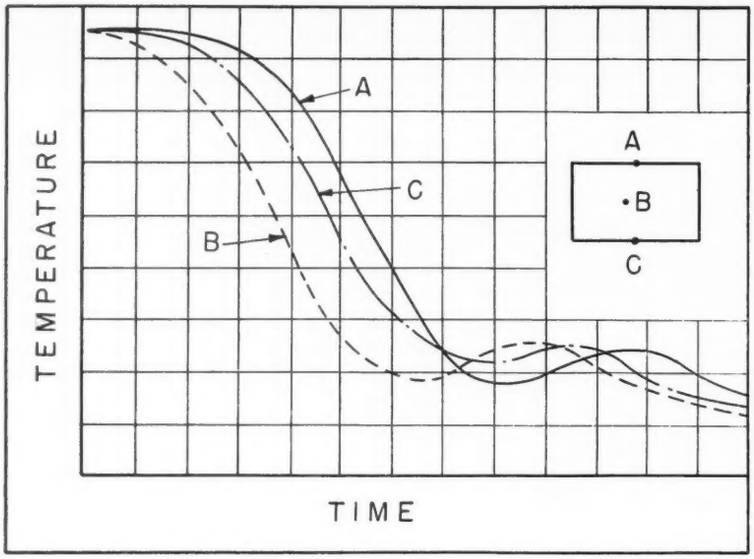


Fig. 1. Curves showing unequal cooling rates of points (A), (B), and (C) on a steel block that is being heat-treated—a condition that results in distortion. By studying the rates of cooling of the various sections of the furnace cooling chamber, the mold, or other part to be heated, can be so positioned that all sections will cool equally, avoiding distortion

tions that may occur near sharp corners, around small holes, and in fragile sections. Minor considerations are machinability and availability of the steel. Steels used at Westinghouse for machined and hobbed molds are listed in Table 1.

All molds are heat-treated in a controlled-atmosphere Amogas furnace using an atmosphere of dissociated ammonia and methane gas. This furnace is equipped with a cooling chamber having the same atmosphere as the heating chamber. The steels used in making the molds are of the air-hardening type. These steels tend to distort less during heat-treatment than an oil-hardening steel such as SAE 3110, which is commonly employed for hobbed molds. Also, they are inherently fine-grained, and need not be annealed after heat-treatment, whereas the grain of an oil-hardening steel coarsens at the hardening temperature and must be refined by a full anneal.

With air-hardening steel and a furnace of known characteristics, the amount of distortion due to heat-treatment can be predicted quite closely, and the direction in which the distortion will occur can also be foretold.

There are four sources of distortion due to heat-treatment. We will consider them in the order of their importance.

First, there is distortion due to differential transformation, which is caused by unequal cooling of the various mold surfaces. Consider a hypothetical case—the heat-treating of a square block such as shown in Fig. 1. The cooling rate of the three points *A*, *B*, and *C* might be as shown by the curves, in which case the piece would distort because of unequal cooling. Point *B*, being in the center of the piece, cannot lose heat as fast as points *A* and *C*, but the part can be so positioned in the cooling chamber of the furnace that the cooling rates of points *A* and *C* can be equalized.

This type of distortion is affected by the shape of the piece and by the cooling characteristics of the furnace. A study of the rate of cooling of the various sections of the cooling chamber of the furnace will permit the mold to be placed so that all sections cool equally. If the mold is to be air-cooled, the best plan is to suspend it from a rack in still air, in order to equalize the cooling of all surfaces.

Second, distortion may be due to anisotropic growth, which is caused by the tendency of the material to grow when heated. Unfortunately, the growth is not equal in all directions, but the amount of growth can be predicted by experience. The only step that can be taken to minimize this type of distortion is to use a steel that does not display this tendency, and cross forge it to break up the crystalline structure.

A third cause of distortion is creep or sag. This type of distortion can be eliminated by properly supporting the mold during the heat-treating cycle. A corrugated furnace tray, made from a material such as a nickel-chrome alloy steel that maintains its strength at high temperature, helps minimize the trouble.

Fourth, distortion may result from residual stresses in the mold. If a fully annealed material is specified, distortion of this type is relatively unimportant.

Chromium-Plating Molds to Prevent Corrosion

In some cases, molds are chromium-plated following heat-treatment. This procedure often is recommended when the mold is to be in intermittent service and will be stored for long periods of time. In such cases, only enough chromium is

deposited on the mold to provide protection against corrosion, a thickness of about 0.00025 inch usually being sufficient. A flash of chromium (0.000002 inch) is not satisfactory.

For cold molds, in which abrasive material such as Portland cement and a filler may be molded, a chromium plate 0.001 inch thick is often used to provide abrasion resistance. Chromium is the hardest plate that can be deposited practically, and so is ideal for this purpose. As soon as the plate becomes thin and the mold surface shows through, the chromium should be stripped and the mold replated.

Although chromium plating is sometimes specified to insure better strippability of the plastic part from the mold, the advisability of this procedure is debatable, depending to a large extent on the nature of the mold design. Chromium plate is difficult to deposit uniformly. The deposit tends to build up on projections and corners. A heavy plate may cause variations in tolerances and may show a tendency to crack and chip.

The only method by which plate uniformity can be obtained is by the use of an anode that follows the contour of the mold. Obviously, this is expensive and often impractical, especially when the mold design is intricate. Plating for strippability, therefore, is usually restricted to molds with large surface areas. It is not used on molds that have deep cavities or intricate and delicate sections. On such parts, it is cheaper to provide strippability by larger drafts or wider tolerances than to attempt to electroplate the mold.

Regardless of the reason for plating, the thickness of the plate should not exceed 0.001 to 0.0015 inch, because the thicker the plate, the softer it becomes and the greater becomes its tendency to chip; only on molds for soft rubber can a heavier plate be built up without damage.

Principles of Plastic Product Design

Many years of experience with molded plastic products at Westinghouse have resulted in certain empirical rules that should be adhered to if the mold design is to be successful. Such factors as providing sufficient taper on the part so that it can easily be ejected and designing the part without under-cuts are generally well understood. But the correct design of bosses, holes, walls, threads, etc., requires specific knowledge of sound mold engineering practice. Space does not permit a comprehensive discussion of all design principles, but the most important factors can be summarized as follows:

Ribs and bosses should be tapered a minimum

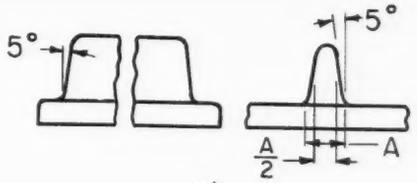


Fig. 2

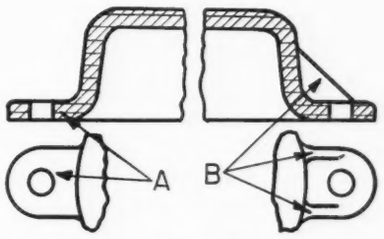


Fig. 3

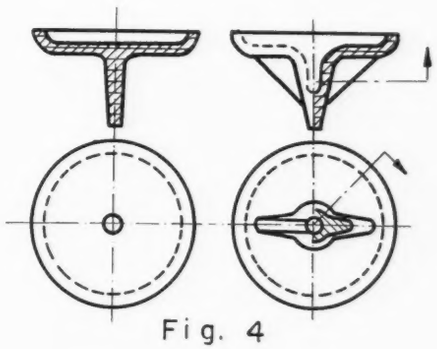


Fig. 4

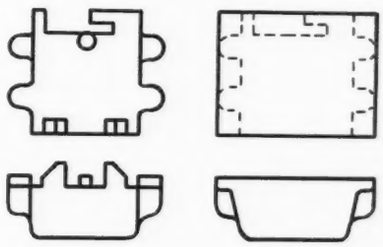


Fig. 5

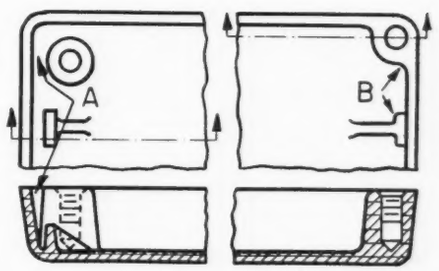
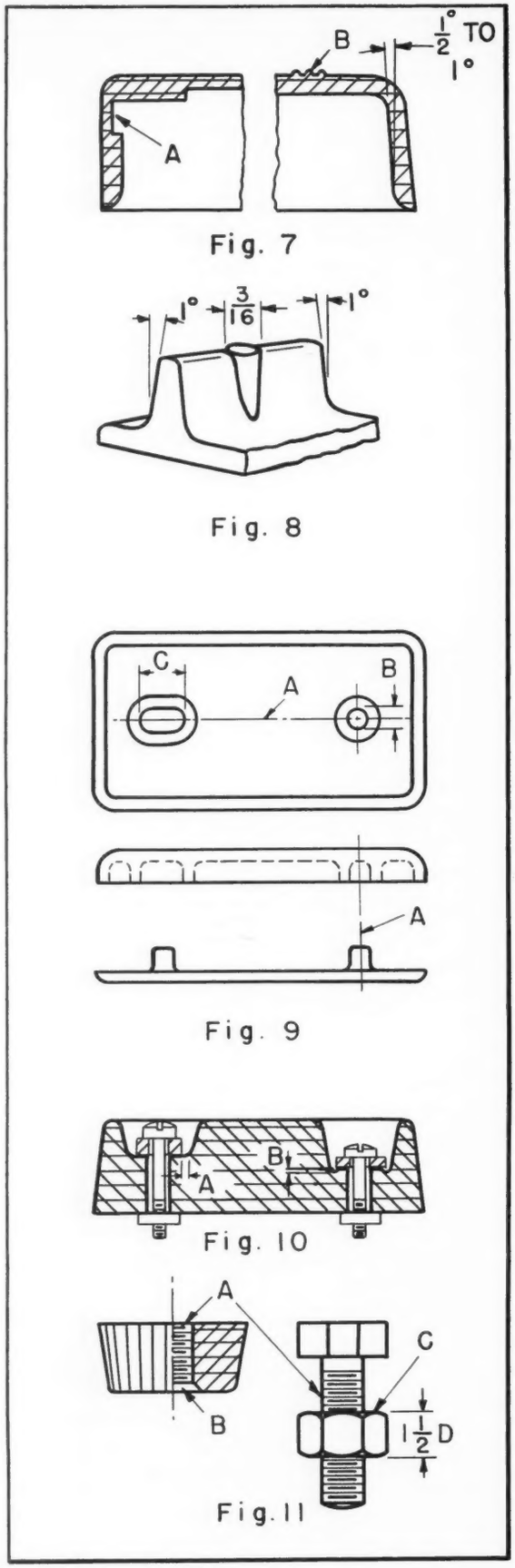


Fig. 6

Figs. 2 to 6. Sketches illustrating general principles in the design of plastic molded parts, such as the design of ribs, bosses, projections, irregular surfaces, etc.



Figs. 7 to 11. Examples illustrating principles involved in designing plastic molded parts having tapers, thin walls, threaded sections, and similar irregularities

of 5 degrees, as shown in Fig. 2. Ribs should not be higher than three times their thickness, and bosses not higher than twice their diameter. Adequate fillets should be provided. To conceal flow lines and shadows opposite ribbed sections, small ridges or raised layers are recommended. Vertical ribbing should be specified for molding deep-drawn parts or for hard-to-mold materials.

Lugs and projections on molded parts, such as shown at *A*, in Fig. 3, should be reinforced by ribs and fillets, as at *B*, to reduce warpage and distortion and to increase the strength of the lugs without increasing their cross-section. Weak lugs or other projections should be avoided by the part designer.

Weak projections, as indicated in the view at the left, Fig. 4, are difficult to mold, and may result in a large number of broken parts. By providing ribs and a recess, as shown in the view at the right, the part is made stronger and lighter and can be more easily molded.

Irregular surfaces at the parting line of the mold, such as shown at *A* in Fig. 5, should be avoided, as they increase initial mold cost, the cost of the molded piece, and the amount of mold maintenance. Intricate and delicate design can be attained by eliminating the difficult projections and joining others with a layer of material, as indicated at *B*.

Bosses and projections that are placed near the wall of a molded piece, as at *A* in Fig. 6, necessitate delicate mold members that are difficult to machine and to maintain in service. When these projections or inserts are designed as at *B*, the mold is strengthened, and the appearance and strength of the molded piece are improved.

Tapers of 1 degree or more are required on vertical surfaces or walls running parallel with the direction of mold pressure, as indicated in Fig. 7, in order to facilitate removal of the parts from the mold cavity. A minimum draft of 1/2 degree may be permissible. A short outside surface—approximately 1/2 inch high—formed by the matrix of a compression mold may, in some cases, have the taper omitted. Under-cuts, as at *A*, should be eliminated, the wall thickness should be uniform, and decorative ridges should be used on large smooth surfaces, as at *B*, to conceal shrinkage and flow lines.

Fillets for strengthening corners should be as ample as possible. Depending on the moldability of the material, a 1/32- to 1/16-inch fillet radius should be provided for a rib up to 1/4 inch high; a 1/16- to 1/8-inch fillet radius for a rib 1/4 to 1/2 inch high; a 3/32- to 3/16-inch fillet radius for a rib 1/2 to 3/4 inch high; and a 1/8- to 1/4-inch fillet radius for a rib 3/4 inch high. A

thin wall or barrier requires a minimum draft of 1 degree on both sides, as shown in Fig. 8, and a minimum surface of 3/16 inch should be provided underneath thin ribs, barriers, or inside walls for the stripper or ejector pin.

Basic lines, as represented at *A* in Fig. 9, should be established for dimensioning and specifying tolerances, in order to eliminate loose fits. The use of a round hole *B* with a slot or oblong hole *C* for mating mold members reduces the necessity of obtaining close tolerances, and results in a mold that is easier to design, machine, and use.

Clearance should be provided at points where wear may occur, as indicated at *A* in Fig. 10. Grooves, slots, or ridges under assembled parts, such as shown at *B*, provide for wear and permit the parts to be seated flat. A 1/32-inch groove is the minimum that should be specified.

Threaded sections, such as seen at *A*, Fig. 11, should be cut after molding if the nominal diameter is below 5/16 inch; otherwise, the threads can be molded. National Coarse Threads should be specified for both molded and cut threads. Class 2 fits can be obtained by molding, and Class 1 fits by cutting the threads after molding.

Threaded blind holes, both cut and molded, should be made deeper than the required depth of the threaded part in order to prevent stripping of the thread. In the case of cut threads, the depth of hole should be increased by one-half the thread diameter, and in the case of molded threads, by one-fourth the thread diameter. Threaded through holes should be countersunk, as at *B*, in order to eliminate chipping. Owing to shrinkage, a long molded thread will not mate with a standard metal thread, but will mate with a molded thread or a short metal thread about 1 1/2 times its diameter, as indicated at *C*.

Special inserts anchored at holes in the mold instead of on pins should be designed with the embedded section limited to 150 per cent of the diameter. They should have round, smooth shoulders in order to provide a good seal, as shown at the right in Fig. 12. The threads should end at a minimum distance of 1/16 inch from the shoulder. Standard bolts and screws, such as indicated at the left, are not suitable for molded inserts because the expense of removing the flash from the projecting surfaces and threads is usually excessive.

Long, slender inserts, as seen at the left in Fig. 13, may be bent during molding. Inserts having a long knurled surface or anchoring shoulders that are far apart (5/8 inch or further, depending upon the shrinkage of the material)

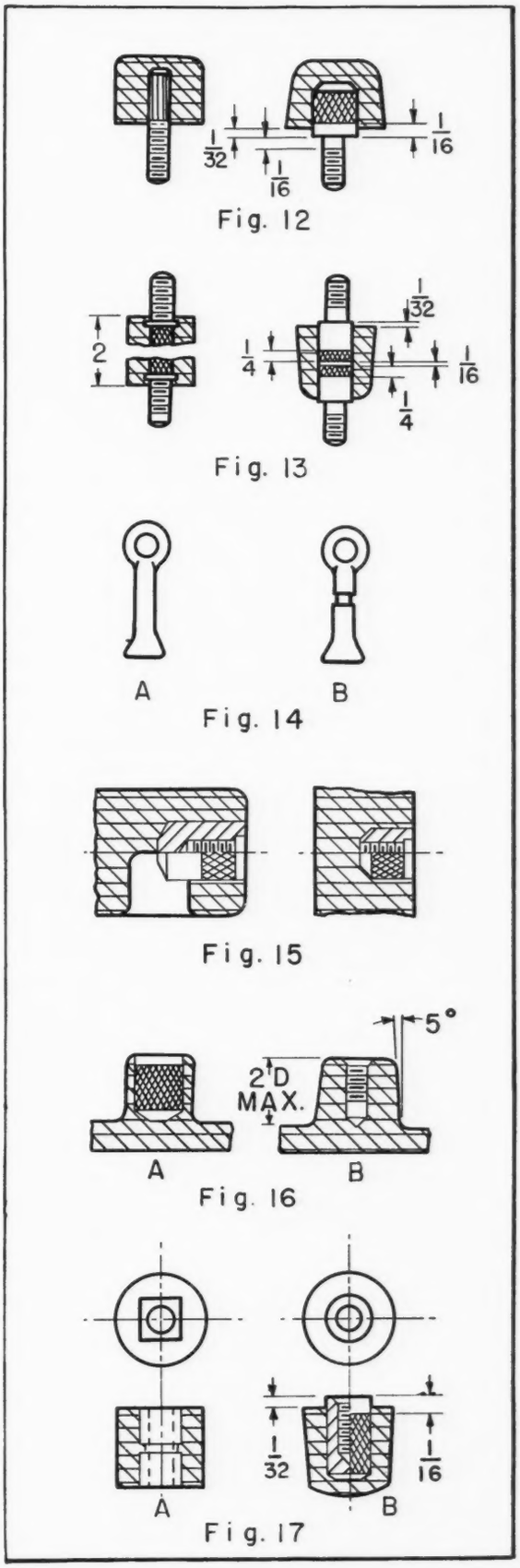


Fig. 12
Fig. 13
Fig. 14
Fig. 15
Fig. 16
Fig. 17

Figs. 12 to 17. Additional examples showing applications of principles governing the design of threaded sections for plastic molded parts and the use of inserts

may cause cracking. Short knurls and short distances between outer shoulders should be specified, as shown at the right, in order to permit the shrinking compound to slide along the free metal ends; or else a low shrinkage compound should be used.

Cast inserts should be machined, as shown at *B* in Fig. 14, at the sealing point of the mold, in order to reduce the flash on the projected surface and hold the casting in the desired position. Flush inserts *A* do not serve the purpose. Inserts should be avoided if a satisfactory assembly can be made with speed nuts, speed clips, spring clips, threads, drive screws, or tubular rivets. In some urea resinoid plastics, inserts are impractical.

Standard inserts in a horizontal position must be supported at both ends during the molding operation. Short inserts, such as shown at the right in Fig. 15, having an embedded length that is shorter than 120 per cent of the diameter may be drilled deeper and the threads retapped, as shown at the left. Horizontal inserts should be avoided when possible because they require special mold construction and molding procedures. Pressed-in inserts should be used if the pull-out load is light.

Inserts should be avoided if they weaken the maximum cross-section permissible for the part, as indicated at *A* in Fig. 16. Molded or drilled holes, together with self-tapping screws, such as shown at *B*, may be used for light loads in permanently assembled parts.

Round inserts *B*, Fig. 17, instead of other shapes, such as shown at *A*, should always be specified because shapes other than round are expensive to anchor and seal in recesses in the mold. Closed-end inserts should be used to prevent the flow of molding material to the inside.

Standard molded-in inserts are held by a diamond knurl on the embedded metal surfaces; a straight knurl does not prevent the insert from being pulled out. It is desirable to provide a smooth shoulder, of 1/16 inch minimum width, on the projecting end of the insert, as this will allow a better seal in the recess of the mold and will not prevent flow of the material to the inside. The embedded end of the insert should not extend close to the surface. The recommended minimum thickness of Moldarta around molded-in inserts should be 3/32 inch for inserts up to 1/4 inch in diameter; 5/32 inch for inserts from 1/4 inch to 1/2 inch in diameter; and 1/4 inch for inserts from 1/2 inch to 1 inch in diameter.

Table 3. Maximum Depth of Molded Vertical Holes and Slots

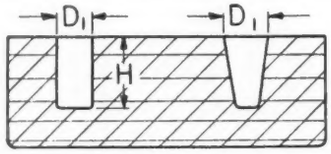
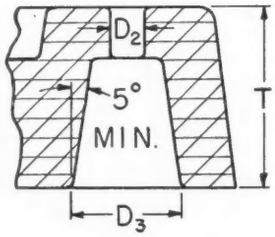
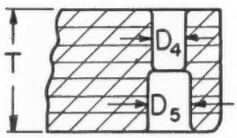
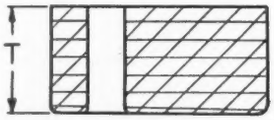
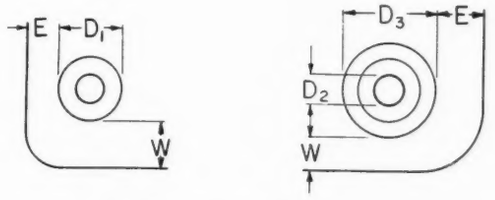
Type of Hole	Molding Method	Maximum Hole Depth	
		Good Moldability	Fair Moldability
 **Blind hole or slot with straight or 5-degree tapered walls**	Compression	$H \leqq 2.5D_1$	$H \leqq 2D_1$
	Transfer	$H \leqq 4D_1$	$H \leqq 3D_1$
 **Through hole with recessed wall**	Compression	$T \leqq 2\ (D_2 + D_3)$	$T \leqq 2\ (D_2 + D_3)$
	Transfer	$T \leqq 4\ (D_2 + D_3)$	$T \leqq 3\ (D_2 + D_3)$
 **Through hole with two diameters**	Compression	$T \leqq 4D_4$	$T \leqq 4D_4$
	Transfer	$T \leqq 8D_4$	$T \leqq 6D_4$
 **Through hole or slot with straight walls**	Compression	$T \leqq$ 3.75 × diam. of hole (or width of slot)	$T \leqq$ 3 × diam. of hole (or width of slot)
	Transfer	$T \leqq$ 4 × diam. of hole (or width of slot)	$T \leqq$ 3 × diam. of hole (or width of slot)

Table 4. Thickness of Walls around Molded Vertical Holes



Hole Dimensions, Inches		Min. Thickness of Walls, Inches		
Diameter	Depth of Hole	Side Wall W	Between Holes	Space for Ejector Pin E
1/16	Up to 1/16	1/16	1/8	3/16
	Over 1/16 to 1/4	3/32	1/8	3/16
	Over 1/4 to 1/2	1/8	5/32	3/16
3/32	Up to 3/32	1/16	1/8	3/16
	Over 3/32 to 3/8	3/32	1/8	3/16
	Over 3/8 to 3/4	5/32	3/16	3/16
1/8	Up to 1/8	3/32	1/8	3/16
	Over 1/8 to 1/2	5/32	3/16	3/16
	Over 1/2 to 1	3/16	7/32	3/16
3/16	Up to 3/16	1/8	5/32	1/4
	Over 3/16 to 3/4	3/16	7/32	1/4
	Over 3/4 to 1 1/2	1/4	9/32	1/4
1/4	Up to 1/4	5/32	3/16	1/4
	Over 1/4 to 1	7/32	1/4	1/4
	Over 1 to 2	9/32	5/16	1/4
5/16	Up to 5/16	5/32	3/16	5/16
	Over 5/16 to 1 1/4	1/4	1/4	5/16
	Over 1 1/4 to 2 1/2	5/16	5/16	5/16
3/8	Up to 3/8	3/16	3/16	3/8
	Over 3/8 to 1 1/2	5/16	5/16	3/8
	Over 1 1/2 to 3	3/8	3/8	3/8
1/2	Up to 1/2	1/4	1/4	1/2
	Over 1/2 to 2	3/8	3/8	1/2
	Over 2 to 4	1/2	1/2	1/2

Molded-in inserts extending through the material should be avoided for compression molded parts.

Round or rectangular holes, slots, and recesses require pins or projections protruding from the cavities of the mold. These mold pins must have fillets at the root to give added strength, and therefore the molded hole will have rounded edges at the top. Also, the pins for forming molded holes wear and thus round off the ends of all blind holes, as well as the sharp corners along rectangular holes and slots. Hence, ample fillets on holes are desirable for economical production and mold maintenance. In case any of the rounded edges or corners are critical for the proper functioning of the assembly or if the radius must not exceed a permissible amount, the maximum allowable fillet radius should be specified on the mold drawing.

Molded horizontal holes are uneconomical, as they require removable mold members. Short side openings or slots sometimes may be formed by vertical mating mold members. Long horizontal holes require a support at the free end of their molding pins, in addition to a removable mold section. It is therefore more economical to drill such holes or other holes that do not have their longitudinal axis parallel with the direction of the molding pressure.

Any holes smaller than 1/16 inch in diameter should be drilled rather than molded, and a maximum limit should be specified in regard to hole depth, depending on the hole diameter, method of molding, and moldability of the material. The data given in Table 3 can be used as a general guide.

It is obvious that a long straight hole requires a long slender pin in the mold, and thus is likely to increase mold breakage. To decrease this tendency, two short pins—one in the upper mold member and another in the lower member—can be used to form a through hole with an offset wall. Mold strength and ruggedness can also be increased by leaving as much material as possible between the walls of the vertical hole and the outside of the mold. The minimum limits for this dimension are indicated in Table 4.

* * *

Contest on "Economy in Production with Tocco Induction Heating"

The Tocco Division of the Ohio Crankshaft Co., Cleveland, Ohio, is sponsoring a contest tied in with the theme "Economy in Production" of the coming National Metal Show. Prizes of $1000, $500, and $250 are being offered for the best article of 250 words or more on the subject "Economy in Production with Tocco Induction Heating." The articles must describe a Tocco installation—actual or proposed—stating the cost savings and production increase attributable to the application of the Tocco process to heat-treating, brazing, soldering, melting, or heating for forging operations. Photographs of the installation or sketches of proposed fixtures or parts must be included.

Papers will be judged by a panel of twelve editors of leading publications in the metal-working field. Entries must be submitted before February 1, 1950. Official entry blanks and complete information concerning the contest can be obtained by writing "Economy in Production Contest," Tocco Division, the Ohio Crankshaft Co., Cleveland 1, Ohio.

Engineering News

Compressible and Expansible Lubricant Developed for Pressurized Valves

The necessity for frequent relubrication of pressurized plug valves used on lines carrying oil, water, gas, and various chemical products has been eliminated by the development of a lubricant called "Hypermatic." This unique lubricant seemingly establishes a new principle in fluid dynamics, since it appears to be the first lubricating compound available that is both compressible and expansible. It embodies dynamic properties that permit energy to be stored for prolonged periods and utilized to provide an automatic feeding action that greatly extends the time between lubricating periods.

The new lubricant is a product of the Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa., and was developed in the research department of the company's Nordstrom Valve Division. It is intended to serve three purposes—to maintain a film on the unexposed valve seat so as to permit easy turning of the plug; to form a pressurized seal around each port by the use of connected grooves on the plug and within the body; and to provide a hydraulic jack action for raising the plug if it becomes difficult to turn.

Lubricant is introduced into the valve through a hole in the shank of the plug. Sticks of lubricant are dropped into the hole and a lubricant screw is inserted, which, when turned, exerts a powerful hydraulic force that transmits the lubricant through the channels. Being compressible, from 50 to 100 per cent more lubricant can be inserted and stored for future use.

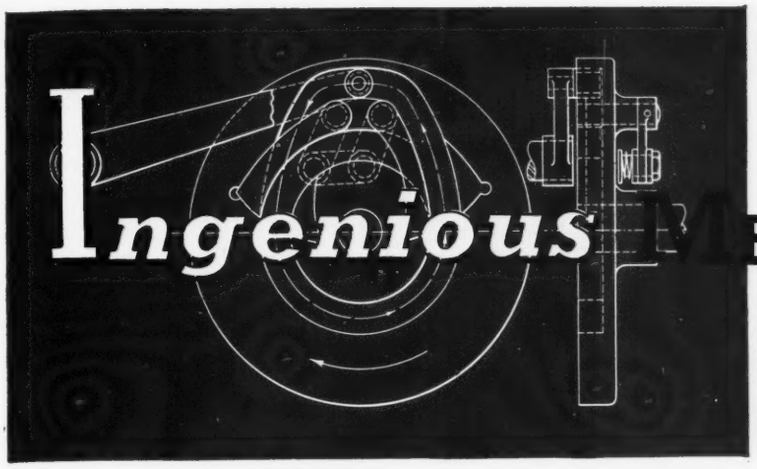
Any amount of pressure can be built up within the valve by turning the pressure screw, but the lubricant will be fed effectively under a pressure as low as 50 pounds per square inch. For very high pressure service, a feeding pressure of 1000 pounds per square inch or even higher can be obtained. The lubricant operates satisfactorily under temperatures from sub-zero up to 250 degrees F.

New Instrument that Weighs Control Samples to High Degree of Accuracy

Weighing control samples and small finished parts to one-twentieth of a milligram with analytical balance accuracy, in one-third the usual time, is made possible by a new direct-reading instrument called the "Gram-atic Balance." The new balance has only one pan, and the weight is read directly on a scale at eye level, eliminating a usual source of error in adding up individual weights. The balance has all weights built in and manipulated by turning four knobs. No weights are handled, weights of less than 0.1 gram being indicated optically and automatically. The instrument has a capacity for samples or parts ranging from 200 grams (about 7 ounces) to 0.0001 gram.

The operation of the balance is simple. Tests have shown that inexperienced operators can learn to weigh samples in twenty to twenty-five seconds after less than an hour's practice. Because of its speed and simplicity of operation, the new balance is suitable for production control at test stations in metal-working plants.

Weighing control samples to a high degree of accuracy on a new direct-reading instrument with only one pan



Ingenious MECHANISMS

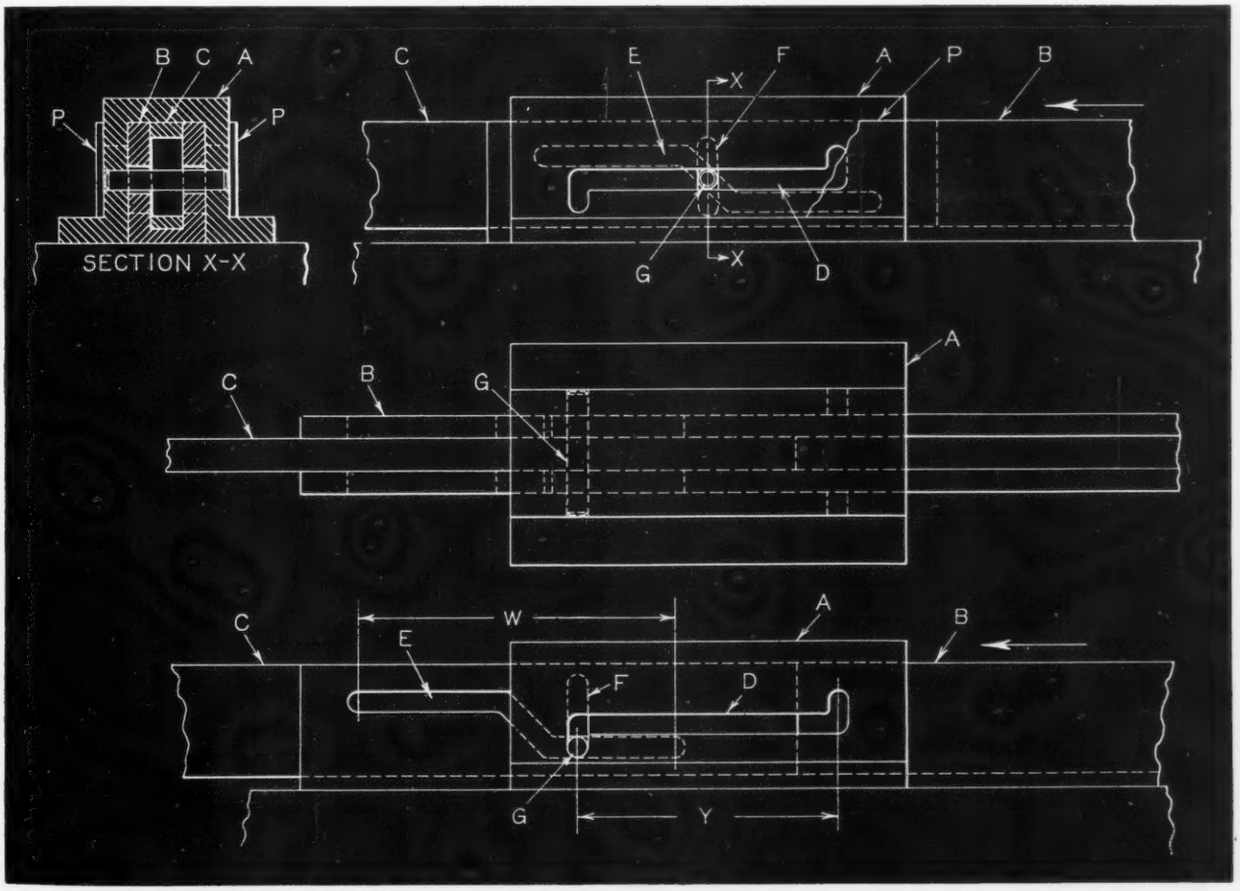
Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Mechanism for Converting Uniform into Intermittent Reciprocating Motion

By L. KASPER

A machine for fabricating a wire product is required to move the work at various stages of the operating cycle by means of reciprocating push-rods. Because of a change in the product, it became necessary to reduce the length of the reciprocating movement and provide a period of rest without any major alteration in the actuating mechanism, which is required to operate other units of the machine. The changed mechanism by means of which the desired motion was accomplished is shown in the accompanying illustration.

Referring to the two upper views, a channel was machined in the original reciprocating push-rod *B* to carry the auxiliary rod *C*, which was made to slide within the channel. The block *A* serves as a guide for the assembly and, by means



Mechanism designed to convert uniform reciprocating motion of bar (B) into intermittent reciprocating motion of bar (C)

of the irregular slots *D* in its outer walls, aids in converting the uniform motion of rod *B* into the intermittent motion required for rod *C*. The irregular slot *D* is machined in both outer walls of part *A* so that the slots are in alignment and pin *G* will slide freely therein. A slot *E* likewise is machined in both walls of rod *B* so that pin *G* will slide freely. Rod *C* is also provided with a slot for pin *G*, as shown at *F*. This completes the assembly, except for the two plates *P* which serve as retainers for pin *G*. These plates, however, are not shown in the two lower views, which illustrate the operation of the mechanism.

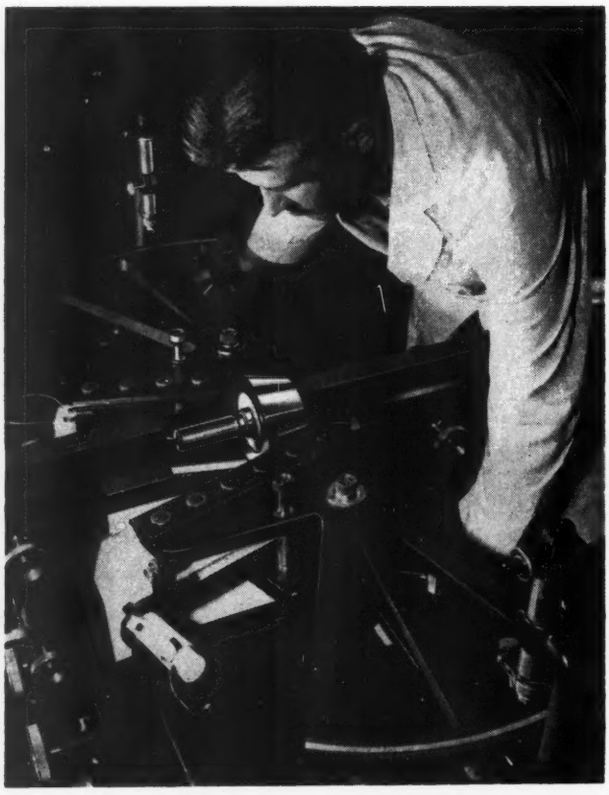
Referring to the top view, assume that bar *B* is moving in the direction indicated by the arrow and that pin *G*, at this point, lies in the angular section of slots *E* in bar *B*, and in the center of the slot *F* in bar *C*. Any horizontal motion given to pin *G*, which passes through the vertical slot in bar *C*, must produce a corresponding movement of bar *C*. In the position shown, pin *G* is free to move horizontally in the slots *D* in part *A*, but is restricted from any vertical movement. As bar *B* is the actuating member and as pin *G* is locked in the angular section of slots *E* in bar *B* by the restricting influence of slots *D*, bar *C* is carried along with bar *B*, which transmits its motion to bar *C* through the slot *F*.

The rest or dwell portions of the cycle are accomplished in the following manner: Continued movement of bar *B* in the direction indicated by the arrow moves pin *G* to the ends of slots *D*, thereby preventing further horizontal movement of pin *G*. When this occurs, the angular portion of slots *E* in bar *B* forces pin *G* into the pockets at the ends of slots *D*, as shown in the bottom view. In this position, bar *C* is incapable of further horizontal movement, because it is locked to part *A* by the pin *G*. As pin *G* is now in the horizontal portions of slots *E*, bar *B* continues its motion in the direction of the arrow without transmitting any motion to pin *G* or bar *C*.

Reversal of bar *B* takes place before the ends of slots *E* strike pin *G*. The horizontal movement of bar *C* is thus controlled by the length of slots *D*, or the distance indicated by *Y* in the bottom view. The maximum movement of bar *B* equals the distance *Y* plus twice the distance indicated by *W*. The mechanism operates in a similar manner on the reverse stroke of the reciprocating driving bar *B*, pin *G* moving upward, however, when it reaches the ends of slots *D*, instead of downward.

* * *

Temperatures as low as 459 degrees F. below zero will be commonplace in a new $250,000 research laboratory recently completed by the General Electric Co., Schenectady, N. Y.



Gaging device for measuring taper or angle of taper which was developed by engineers of the Timken Roller Bearing Co. and the Warner & Swasey Co. Optical microscopes facilitate the making of settings to an unusually high degree of accuracy

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Quick-Acting Attachment for Lathe Tailstock

By ROBERT MAWSON, Providence, R. I.

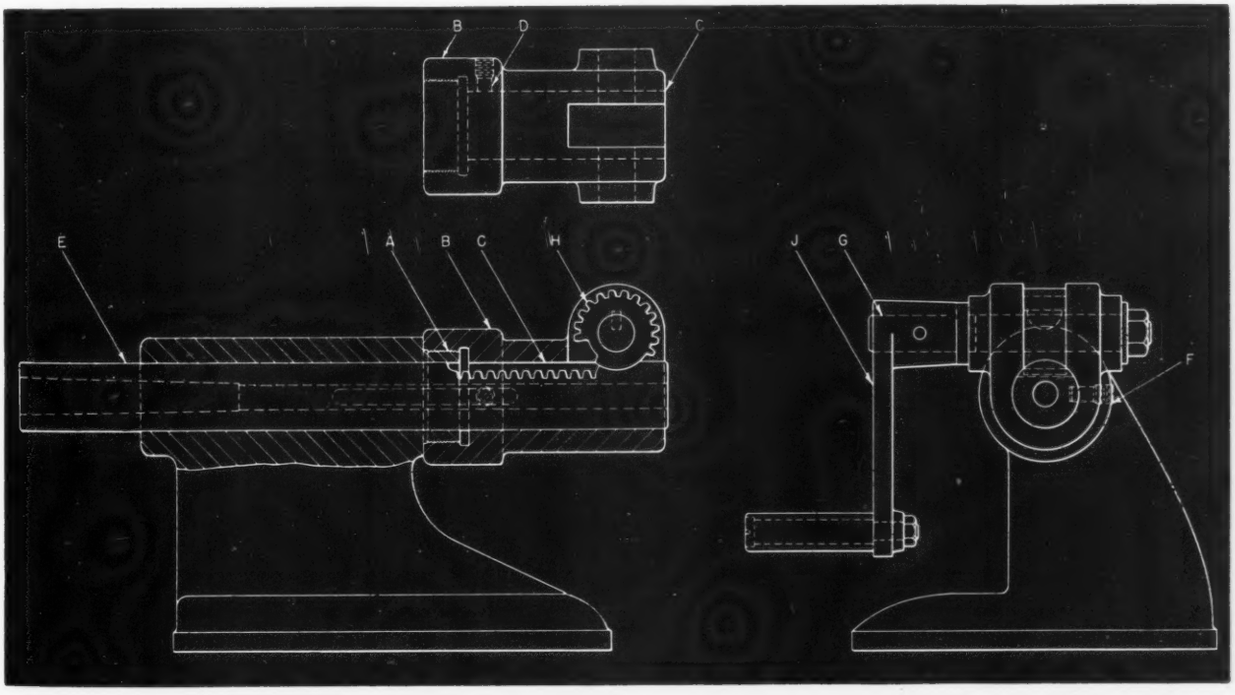
Because of the slow movement of standard tailstock spindles, considerable time is lost in loading and removing work of varying lengths held between centers in a lathe. To reduce the time required for these operations, a standard tailstock was modified as shown in the accompanying illustration.

The rear end of the tailstock was turned, threaded, and faced, as shown at *A*, to provide a locating surface and shoulder. A cast-iron extension *B* was machined to fit the threaded portion of the tailstock body, and a hole *C* was bored in the extension to the same size as the hole for the spindle in the tailstock body. At one end, the extension has two bosses equidistant from the center of the bored hole, as shown in the plan view. These bosses were drilled and reamed and a slot machined between them for assembly with a gear and shaft. Near the other end of the extension is a reamed hole *D*, which is tapped for assembly with a hardened tool-steel screw *F*.

The tailstock spindle *E* is made of machine steel, and is a sliding fit in the bored holes in the tailstock body and extension. The forward portion of the spindle has a tapered hole to suit the center used in the lathe tailstock. Rack teeth and a groove are machined in the rear end of the spindle. The end of screw *F* fits into this groove to keep the spindle in alignment as it is moved in and out of the tailstock.

A casehardened machine-steel shaft *G* is a running fit in the holes in the extension bosses. This shaft has a shoulder at one end that rests against the outer surface of one of the bosses. The opposite end of the shaft is threaded to receive a nut, which is tightened against the boss to hold the shaft in position. Fastened to the shaft *G* with a taper pin is a handle *J*.

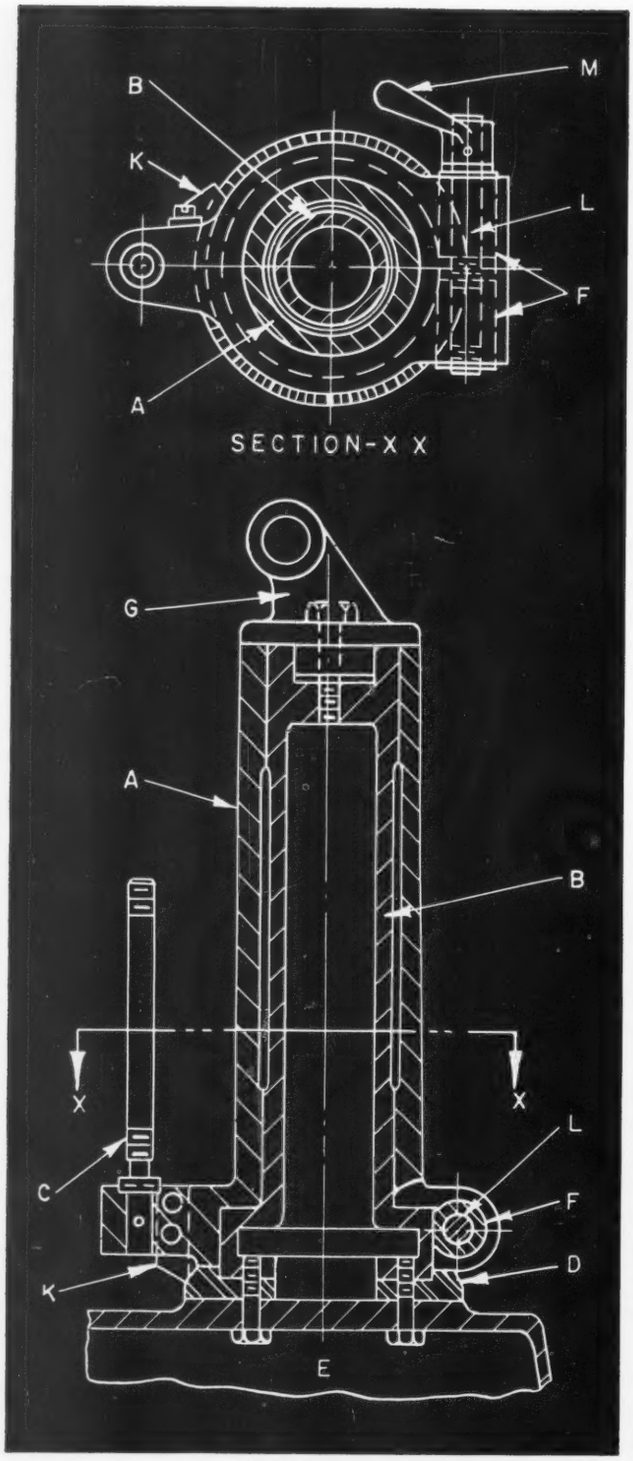
A tool-steel Geneva gear *H* which engages the rack teeth on the spindle is held on shaft *G* by a



Lathe tailstock attachment that permits work of varying lengths to be quickly loaded and removed

Woodruff key. The teeth on the Geneva gear cover 220 degrees of the periphery, which has a reduced diameter for 40 degrees. The remaining untoothed portion of the gear periphery engages a mating contour on the spindle *E*.

To use the attachment, the tailstock is positioned on the lathe bed so that the plain portions of the gear and spindle are in contact, as shown in the illustration, with the tailstock center supporting the work-piece. The tailstock body is secured to the bed of the lathe in the conventional manner. The work-piece may be held in a chuck or faceplate at the headstock and in a center at the tailstock or between centers in the headstock and tailstock, depending upon the requirements of the operation.



A swiveling mounting design in which member (A) can be rotated to any desired angular position about post (B) and clamped securely in place

To remove a machined work-piece, the Geneva gear is rotated counter-clockwise by means of the handle *J*. This brings the gear teeth into mesh with the teeth on the spindle, and continued rotation of the gear will draw the spindle back, thereby removing the center from the work-piece.

To load the work into the lathe, the gear is rotated in a clockwise direction, which moves the spindle out of the tailstock until the center enters the center hole in the work-piece, thus supporting the work for the machining operation. When the gear and spindle are in the position illustrated, the spindle is held rigidly by engagement of the mating contours, and cannot slide back out of the work-piece.

With this tailstock attachment, the operation of loading and unloading a lathe is performed quickly and positively, and lost time is greatly reduced.

Swivel Mounting with Indicator for Accurate Positioning

By F. SERVER

In designing one part of a grinding machine, it was necessary to provide a swivel mounting that could be accurately clamped in any desired angular position. The mounting designed for this purpose is shown in the accompanying illustration.

Member *A*, supporting a table adjusting mechanism (not shown), of which screw *C* is a part, can be swung about the stationary cylindrical post *B*. Beneath the post is an index-plate *D* having angular graduations engraved around its periphery. Both post and plate are bolted to the base *E* of the machine. Bracket *G*, for supporting the grinding wheel spindle, is bolted to the top of the post.

An indicator *K*, fastened to member *A*, shows the amount of rotation. Member *A* is split at one end, and bored to accommodate bushings *F*. Screw *L*, operated by lever *M*, is used to bring the bushings together for clamping member *A* in any desired position, or to separate them so that member *A* can rotate. In clamping, the

bushings bind against post *B*. Clearance recesses are provided between the upper and lower bearing surfaces on both swiveling member and post to reduce the amount of machining required.

Clip-Forming Die

By L. KASPER, Philadelphia, Pa.

The die illustrated was designed to form clips such as shown at *W* in Fig. 1. These clips are made from hot-rolled, low-carbon sheet steel, and are used as clamps in the assembly of a wire product. One design requirement is that the sides contact each other at the formed section in the center of the clip with a specified pressure. The small hole in the bottom of the part is necessary only to prevent slipping of the strip stock while it is being formed.

The relative positions of the die members at the beginning of the forming operation are shown in Fig. 1, and at the end of the operation in Fig. 2. Blocks *B* and *H* are secured to baseplate *A*, space being provided between the blocks to permit the entry of punch *J*. Strip stock *N* is fed through the grooved guide block *F* until it comes in contact with stop *E*, when it is cut to the desired length by punch *J*. The guide block has been omitted from the end view of the die in Fig. 1.

An H-shaped block *C* is held in a recess in block *B* by plates *G*. Block *C* is free to slide vertically, but until forming punch *K* descends, it is held up against shoulders in block *B* by spring *P*. The two forming blocks *D* are free to swing about pins within the openings in block *C*. Forming punch *K* contains a rectangular hole into which the material is pressed by the forming blocks *D*. A pilot pin on the lower end of the forming punch enters a hole previously pierced in the strip to prevent slipping of the stock.

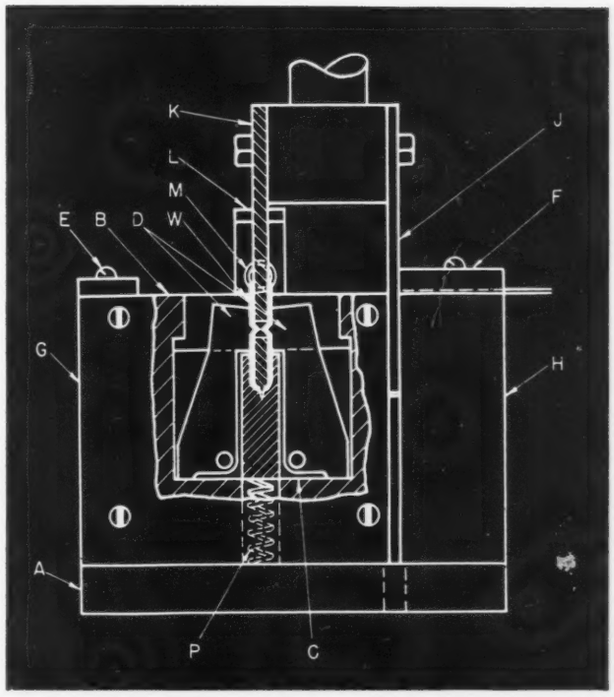


Fig. 2. View showing the position of the die members at the end of the forming operation. Here forming blocks (D) have been forced together to press the work-piece into a rectangular opening in punch (K)

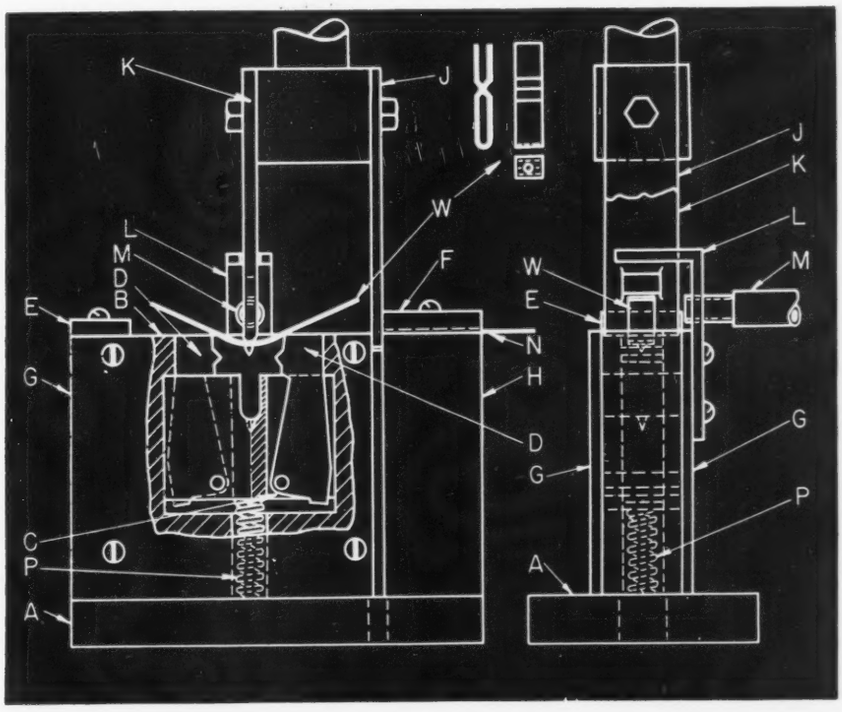


Fig. 1. Strip stock (N) is sheared to length by punch (J) and then bent between forming blocks (D) by punch (K)

After the work-piece has been cut to length from the strip stock, as shown in Fig. 1, the forming punch bends it between the upper inside corners of forming blocks *D*. This temporary bend is ironed out as the work is forced into the groove in the center of block *C*. Block *C* is prevented from moving downward by the resistance of spring *P* until the center of the work-piece is forced to the bottom of this groove. Then continued descent of the press ram forces block *C* downward until the lower ends of the forming blocks come in contact with the bottom of the opening in block *B*. This causes the blocks to pivot toward each other, thus forcing the work-piece into the opening in the forming punch, as shown in Fig. 2.

On the upward stroke of the ram, the forming blocks return to their original positions. This permits the formed clip to be carried upward until it is removed from the punch by stripper *L*. A blast of air from tube *M* then blows the clip clear of the die. The die is operated at 200 strokes per minute.

Method of Laying Out Conical Shapes to Specific Dimensions

By GEORGE PHEIL, Racine, Wis.

When it is desired to construct a conical part of specific dimensions, a lay-out is required in order to save time and material. The design of an oil slinger for assembly to a tapered machine part presents a typical lay-out problem which is conveniently solved by the method described in the following.

The procedure to follow in constructing an oil slinger for the rotating, circular machine member shown at *A* in the accompanying illustration is as follows:

1. Select the desired position for the oil slinger on the tapered surface of the work consistent with the design and clearances desired.

2. After selecting radii *X* and *Y* and angle *L*, extend the angle to a point *O* on the center line of the part.

3. By trigonometry, $M = X$ (cosec L degrees) and $N = Y$ (cosec L degrees).

4. With *M* as a radius, scribe a circle as shown at *B*.

5. With *N* as a radius and using the same center as for the first circle, scribe a second circle.

6. Determine the circumference of a circle having a radius *X*. (Circumference $= 2 \times 3.1416 \times$ radius)

7. Select any starting point, and with dividers, step off the distance of this circumference along the inner circle shown at *B*, using increments small enough for accurate results.

8. Determine the circumference of a circle with the radius *Y*.

9. From a starting point aligned with the starting point used on the inner circle, step off this circumference on the outer circle shown at *B*.

10. By proportion, angle *S* equals:

$$360^\circ - \left(\frac{\text{Circum. of circle with radius } X}{\text{Circum. of circle with radius } M} \times 360^\circ \right)$$

With radii *M* and *N* and angle *S* laid out, the circular ring sector shown at *B* can be constructed of soft sheet steel of the desired gage. After cutting out the ring sector determined by angle *S*, the ends of the ring sector can be attached to form a cone which is assembled to the tapered member shown at *A* and welded or brazed in place.

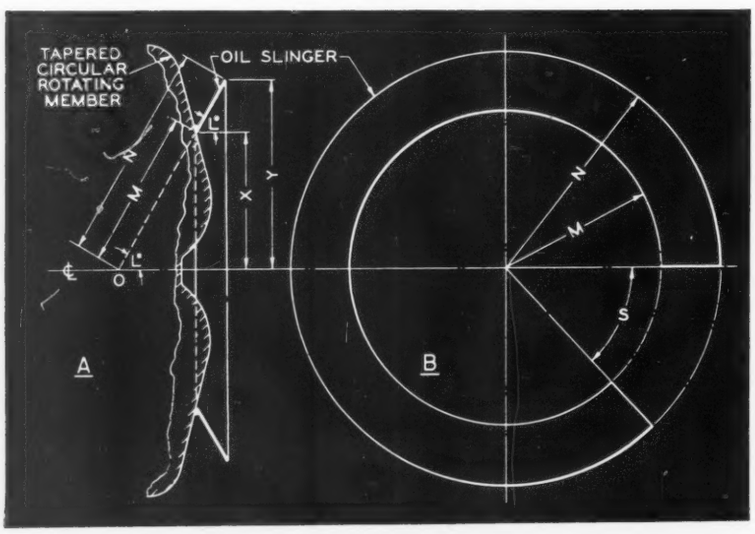


Diagram illustrating method of laying out a conical oil slinger for assembly to a tapered machine member

Determining the Approximate Brinell Hardness of Large Parts

By FRED B. MONEY

Brinell hardness and probable tensile strength of ferrous forgings, castings, or large parts that are inconvenient or impossible to test on conventional or available hardness testing machines can be determined with reasonable accuracy by means of the method here described. With this method, impressions are made simultaneously in a test block and in the part to be tested. The ratio of the square of the impression diameter in the test block to the square of the impression diameter in the part will be equal to the ratio of the unknown hardness of the part to the known hardness of the test block. This can be expressed by the formula:

$$\frac{D^2}{d^2} = \frac{bhn}{BHN}$$

or

$$bhn = \left(\frac{D}{d}\right)^2 \times BHN$$

where

bhn = Brinell hardness of part;
D = impression diameter in test block;
BHN = Brinell hardness of test block; and
d = impression diameter in part.

Test blocks, approximately 1 inch in diameter by 3 inches long, can be sawed from mild or medium steel bar stock. The ends of the blocks should be ground or filed to reasonable smoothness, and their average hardness determined by means of a standard Brinell testing machine. A disk, about 1 inch in diameter by 3/8 inch thick, is made from wax, clay, or gum, and a standard Brinell ball, 10 millimeters in diameter, is pressed through the disk at the center, so that it extends on both sides. This arrangement makes the ball easy to handle and prevents it from becoming lost, especially when subsequently struck.

A spot free from scale and decarburization is selected or prepared on the part to be tested. The disk containing the ball is placed on this spot, and one of the test blocks is placed over the disk, with the under side of the block in contact with the ball. Holding the test block steady in the left hand, the top of the block is struck a clean blow with a hammer weighing from 3 to 4 pounds, held in the right hand. The hard steel ball will make an impression in both the test block and the work. The diameters of these impressions can be measured by means of a standard Brinell microscope, and the hardness of the piece being tested can be determined by the formula given in the foregoing.

A fair approximation of the probable tensile strength of steels, in pounds per square inch, can be obtained by multiplying the Brinell hardness number by 500. (Except in special cases this relationship does not ordinarily apply to nonferrous metals.) To obtain an even closer approximation of tensile strength, Brineil numbers up to 150 may be multiplied by 510, Brinell numbers from 150 to 200 by 500, and Brinell numbers over 200 may be multiplied by 490.

An unusual application of a power press brake at the Texas Engineering & Mfg. Co., Inc., Dallas, Tex. Large envelopes are being made from cellulose acetate in an electrically heated die

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Injury from a Borrowed Machine

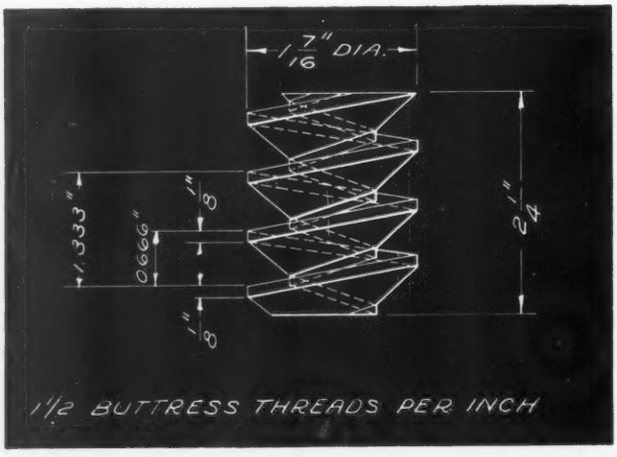
C. W.—Recently I lent a machine tool to a competitor as an accommodation. While he was operating the machine, he was injured. Now he is suing me for $20,000, claiming that the machine was defective. Can he collect damages?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

According to a higher court ruling, a person lending equipment is liable for damages if he fails to determine whether the equipment is in safe condition. In Bonvillain vs. Operators, Inc. [26 So. (2d) 25], the testimony proved the following facts: The owner of a machine lent it to a friend. The latter was using it when it broke, and sustained a severe injury. The higher court allowed him $42,083 damages, saying: "He (the owner) assumed a responsibility and became liable to anyone who might be injured."

What is the Most Efficient Way of Producing This Buttress-Thread Part?

A. H. B.—The cold-rolled steel part with buttress thread shown in the accompanying illustration is to be made in lots of 10,000 to 50,000 pieces, after which the parts are to be casehardened. Suggestions as to whether they can be made most efficiently by thread rolling, grinding, or milling will be appreciated.



Answered by
August J. Howarth
Westlake, Ohio

Experience in producing a similar part from aluminum stock by hobbing the thread prompts the writer to suggest that the same method might be employed in this case. The thread appears to be too deep to roll successfully, and milling would be too slow a process. The writer believes, however, that the thread could be hobbed at a satisfactory production rate either on a hand-operated or automatic screw machine, mounting the hob on the cross-slide. The hob can be located on the cross-slide in either the front or rear position, with the cut-off tool in the opposite position.

In the case of the 6-pitch aluminum part referred to, the hob was operated at a very high speed. About sixteen million of the aluminum pieces were produced in a year, no difficulty being experienced in threading them by the hobbing method. For this thread-hobbing job, we rigged up our own cross-slide hob, but manufacturers of screw machines and screw machine tools could doubtless furnish equipment for hobbing a buttress thread such as the one shown in the illustration.

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Scholarships Awarded by American Steel & Wire Co.

The American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, Ohio, a subsidiary of the United States Steel Corporation, has established two full-time day-school scholarships for the company's employes and their sons at the College of Engineering and Science, Case Institute of Technology in Cleveland, beginning with the academic year 1949-50.

The scholarships cover tuition for a complete four-year college course, provided that high academic and personal standards are maintained and the students receive the recommendations of the Case Scholarship Committee. The first two winners of these scholarships are John Gonzalez, son of a fireman at the Donora, Pa., Zinc Works of the company; and Richard J. Rozanc, son of a cold-roll operator at the Cuyahoga Works.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

Are You a Team Captain?

NO matter how clever the captain may be it is the football team that wins the game. Like football, modern selling requires teamwork. Often the team members who stay at headquarters never actually get a chance to carry the ball. On the other hand, particularly on larger jobs, they may help by carrying the ball to complete the play or touchdown.

Machine tools and customers' problems have become so complicated that frequently the salesman can't possibly complete every play himself. In reality, the salesman is a captain of a team. No wise captain fails to use other players. He must utilize the skill of each player at the right time and in the right place, but he must never lose command. Remember that the prospect looks to the salesman, for in his eyes the salesman is the embodiment of the supplier.

How then can you, as a team captain, best use other talents within your organization to do a complete selling job? Let us focus upon those men the salesman brings to the prospect to help to sell the job. These suggestions may have value:

1. Don't be afraid to call for help, but make sure the occasion justifies the time and expense.

2. Have a plan. Determine the type of help required. Weigh matters of personality carefully. Be reasonably sure the expert from headquarters and the individual prospect are likely to get on together, and talk the same language. One "home-base" engineer I know has a brilliant mind, but experience has shown that he gets into technical arguments with prospects—and always wins them—but helps to lose the order.

3. Establish time, place, and person for the visit to avoid lost motion. Lots of headquarters men have travelled hundreds of miles to see a prospect, only to sit around, or return empty-handed. Results? Irritation and waste.

4. Make sure to give your visiting team-mate all the information required. Inform him of the conditions of the negotiation, the general problems existing, the questions uppermost, and particularly the likes, dislikes, and habits of the individuals to be interviewed.

5. Don't dodge responsibility as a team captain. In too many instances, the salesman fails to accompany the visiting expert to the prospect's plant when this is necessary, or to plan the visit properly. In others, the salesman avoids responsibility, letting the team-mate shift for himself.

6. In introducing your team-mate, be sure to make clear his position, experience, and reputation. Mark him well up, but not to the point of embarrassment. "Mr. Johnson—one of our tool designers—happened to be in town, so I brought him along," is a shapeless and colorless introduction. It's a poor start—it's unfair to him. "Mr. Johnson (our top engineer on broaching problems)—you've heard of him—dropped his work to come all the way from Oshkosh to see you . . ." would be much better. Give him a good start. The fact that you got him on the job enhances your importance, proves interest, and may help create obligation.

7. Always steer the interview, particularly when your team-mate is new to the problem and prospect. Don't let the interview get sidetracked or permit friction to develop.

8. After every interview involving a team-mate, button up the facts. Determine the "who, when, and how" of future moves. Further data must usually be furnished to the prospect. Determine whether it should go direct from home office to prospect, with a copy to you, or whether it should pass through your hands. Be sure to capitalize on results.

9. If you finally lose the touchdown, don't blame the players on your team. Learn from experience, and let diplomacy guide both the choice and the operation of your selling team-mates.

10. Don't "gang up" on any prospect. More than one team-mate (or more than two callers

on one prospect) usually places him on the defensive. With several team-mates helping you at one time, schedule their efforts and contacts.

Many of you have heard a remark similar to this "I like to work with Continental Machinery Co. They are a fine team, and Joe Richards, the salesman, has his gang lined up to really give us service."

* * *

Lehigh University and Bethlehem Steel Co. to Cooperate in Metallurgy Course

Lehigh University, in cooperation with the Bethlehem Steel Co., will inaugurate a new program of practical study in metallurgical engineering in the fall semester of 1950. The new graduate curriculum will lead to the degree of Master of Science in Metallurgical Engineering Practice. In addition to facilities on the university campus, a field station will be established at the local plant of the Bethlehem Steel Co.

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Class I railroads and railroad-owned private-controlled refrigerator car companies put 55,158 new freight cars into service during the first six months of 1949. This was the greatest number of new cars placed in operation in any corresponding period since 1925.

New Lincoln Engineering Undergraduate Award and Scholarship Competition

The third annual competition (1949-50) of the Engineering Undergraduate Award and Scholarship Program has recently been announced by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. This program offers annually $6750 in awards and scholarship funds to engineering undergraduate students and to schools for the best papers on arc-welded design, research, fabrication, or maintenance. A total of 77 awards, ranging from $1000 to $25, will be given to students, and $1750 will be awarded to schools for seven scholarships. Complete information, including the rules and conditions, can be obtained from the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

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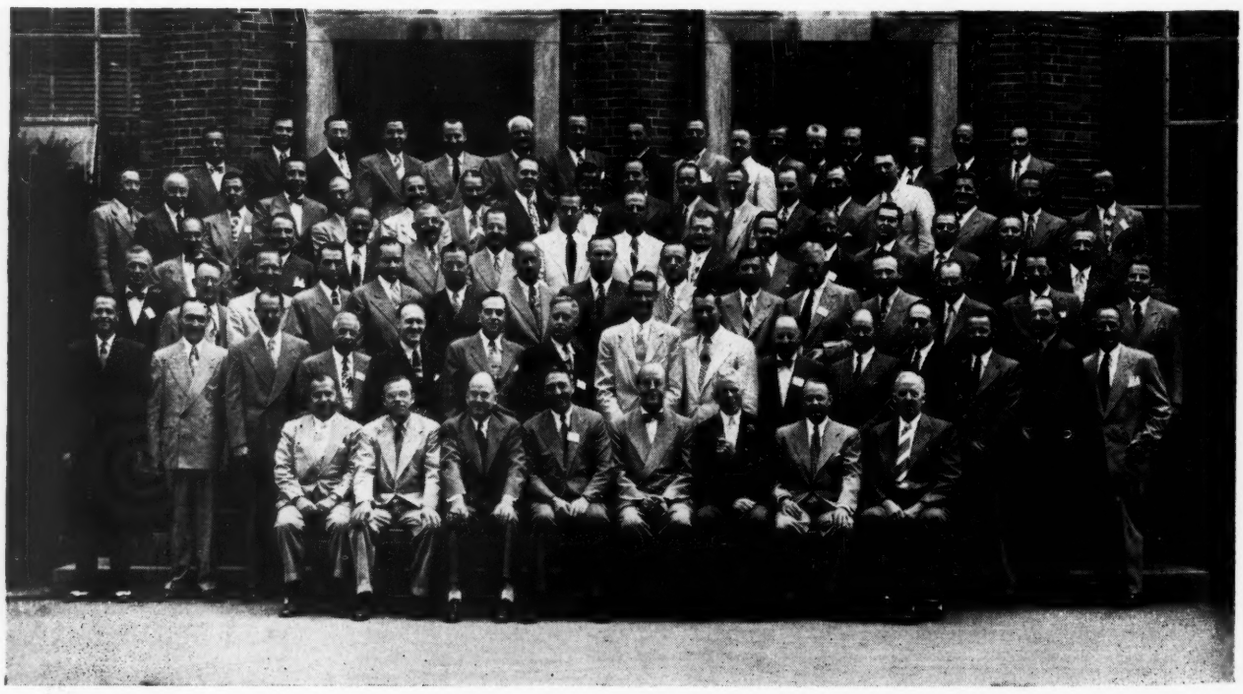
Stevens Institute Offers Four-Year Course in Tool Design

A new four-year course in tool design is now being given by the Industries Training School at Stevens Institute of Technology, Hoboken, N. J. This program includes tool drafting and the design of punches, dies, jigs, fixtures, small tools, and gages. It also covers elements of drafting, properties of materials, shop production methods, time study, and manufacturing planning.

Sales engineers and faculty who attended the Sales Conference recently held at Cornell University under the auspices of the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association. Similar conferences were held at Dartmouth College, Purdue University, and Western Reserve University



Shop Equipment News

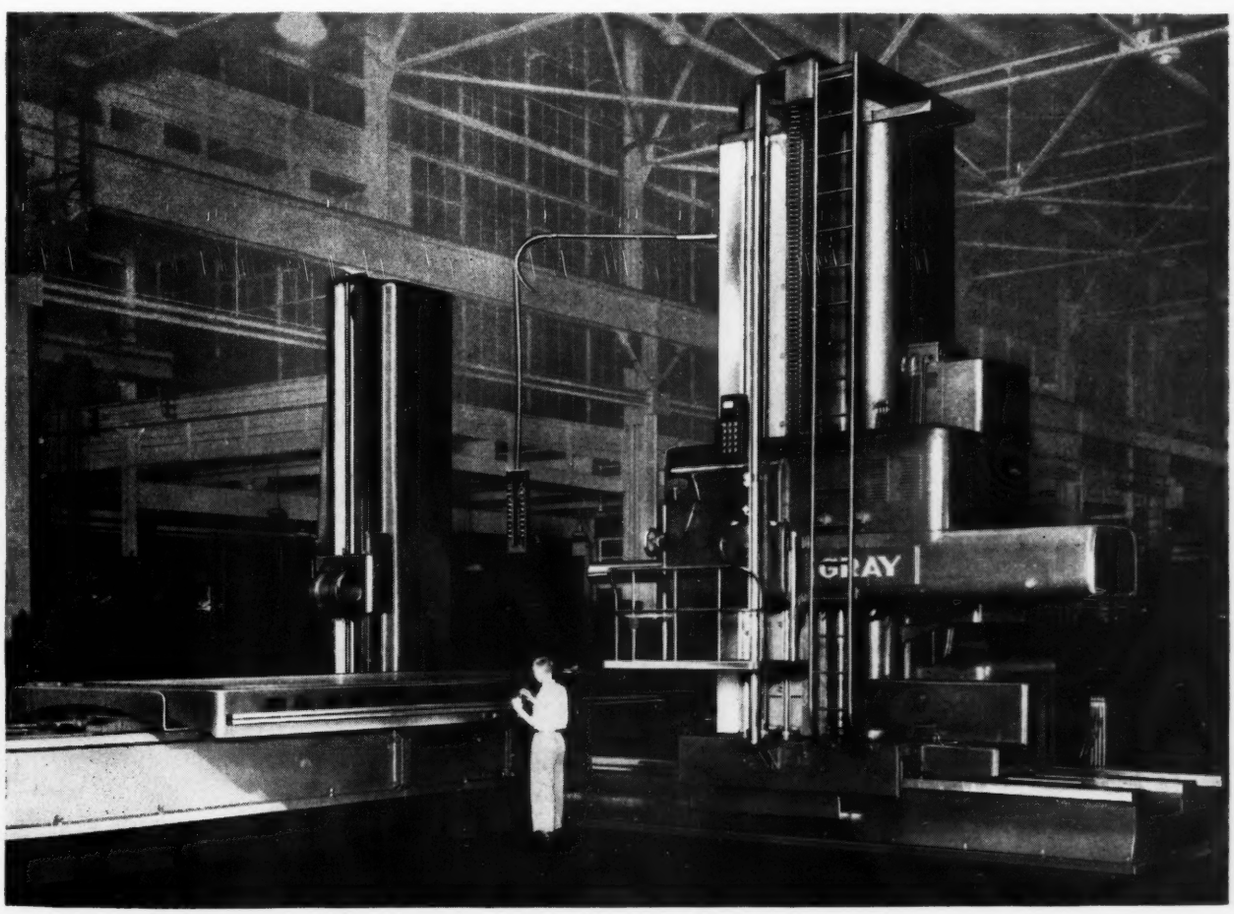
Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Gray Giant-Size, Planer Type, Horizontal Boring, Drilling, and Milling Machine

A huge planer type horizontal boring, drilling, and milling machine has recently been built by the G. A. Gray Co., 3611 Woodburn Ave., Cincinnati 7, Ohio, for the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. The Nitralloy boring and drilling bar of this new machine is 8 inches in diameter and has a continuous feed of 7 feet. The bar is driven by a 75-H.P. alternating-current motor, and has twenty-four speeds which are selectively controlled by three levers. Two of the levers are speed-range selectors, while the third selects the individual speed desired. There are four speed ranges with six speeds in each range. The speed selector can be operated without stopping the bar or the motor. This improved patented feature eliminates much loss of time and inconvenience previously experienced in handling bar work.

The machine controls have been especially designed for simplicity of operation. The controls for the head, column, bar, and table are centralized on the pendent switch, which is mounted and counterbalanced on anti-friction supports to facilitate placing it in any convenient position. Controls for starting, stopping, jogging, and regulating the speed of the variable-voltage feed motors are mounted on the pendent station. Selector switches on this station control the engagement of the clutch and hydraulic clamps of the various units. Motor-operated rheostats are used, and direct reading tachometers are mounted on the pendent station. Controls for the spindle motor are also provided on this station.

Two variable-voltage feed motors are employed, one for feeding and traversing the table and an-



Huge planer type horizontal boring, drilling, and milling machine built by the G. A. Gray Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

other for the column base, head, and bar. Movements of the head and end support are synchronized, and have a vertical travel of 12 feet above the top of the table. The table is 9 feet wide and has a longitudinal movement of 20 feet on the bed. The main column has a feed or rapid traverse movement of 10 feet on the runway. The end support column can be moved 3 feet on its runway.

An outstanding feature of this new machine is the non-metallic way bearings provided for the table, main column base, head guide ways, end support column base, and end support and bar. The table, which will carry extremely heavy loads, is supported on two vee and two flat non-metallic bearing ways. The table is driven by a spiral pinion which meshes directly with the rack. This drive provides a smooth motion and is self-locking under all conditions. Means are provided for eliminating backlash between the pinion and the rack.

The wide, deep, and heavily ribbed runway has three flat ways designed to support the column rigidly, and is furnished with closely spaced leveling screws. The middle way forms a long narrow guide with non-metallic guiding surfaces. A bar aligning device maintains constant contact against one side of the guide to insure smooth straight-line motion of the column when boring operations are being performed by feeding the column instead of the bar.

The "Gray Woodpecker" positioning device permits setting the various units within accuracy limits of 0.00025 inch by pressing a micro-jog button on the pendent switch. A power-driven, heavy-duty rotary indexing table, capable of supporting castings weighing 85 tons, is used with this machine. This table has non-metallic bearing surfaces, and is graduated for a full movement of 360 degrees. It is mounted on top of the regular table, has a working surface of 7 by 8 feet, and is especially designed to save time by reducing the number of set-ups. A conveniently positioned protected dial indicator is used for precision setting of the table by means of a push-button.

A heavy-duty right-angle milling head having a 48-inch extension can be mounted on the machine head. The milling head can be rotated through 360 degrees, and can be securely clamped in any desired position for milling surfaces at any angle.

A 60-inch diameter, continuous-feed, facing and boring head is also used with this machine, which greatly increases its productivity and simplifies difficult machining problems. The front face of the head, which contains the guide for the cross-slide, is of solid cast construction, designed to afford maximum rigidity. Feeding rates to suit any requirements are available. The machine weighs 175 tons. 61

Sheffield Automatic Valve-Tappet Gaging and Segregating Machine

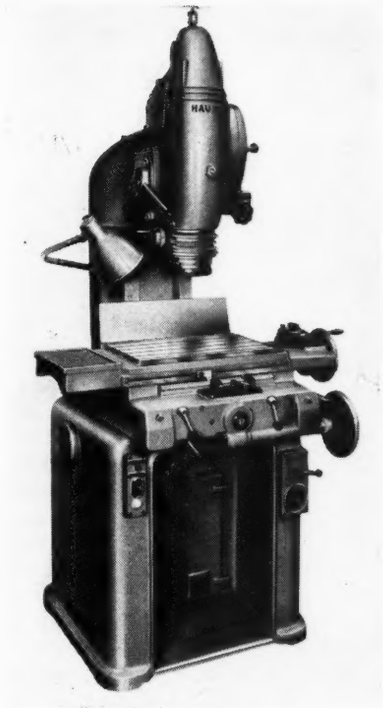
A machine that automatically checks all critical dimensions of an automotive valve tappet and segregates the acceptable, rejected, and salvageable parts has recently been built by the Sheffield Corporation, Dayton 1, Ohio. One worker can operate this machine, which has a cycle capacity of 2000 parts per hour. All checks and segregations are made automatically in less time than was formerly required for individual checks.

Automatic valve-tappet gaging and segregating machine built by the Sheffield Corporation

Included in the various gaging operations are the outside diameters at each end and the taper; the major internal diameter; depth of both major and minor internal diameters; squareness of solid end face with bore; and over-all length. There is also a check for concentricity of internal diameter with outside diameter and for out-of-roundness on 50 per cent of the otherwise acceptable parts that go through the gage. At the various segregating stations, unacceptable parts are ejected in two different chutes, one of which is for completely rejected parts and the other for parts suitable for salvage and reworking.

The machine has a loading station, five gaging stations, five segregating stations, and two unloading stations. Parts are passed through the machine by a walking beam, which lifts and carries them progressively through a series of tungsten-carbide faced vees. Protective switches at each gaging and segregating station stop the machine immediately in case of a jam, and a red light on the panel shows the exact location of the jam. A fixed type snap gage built into the top of the loading chute prevents excessively over-sized parts from entering. The machine is built for continuous mass production, and is designed to require a minimum of maintenance. 62

To obtain additional information on equipment described on this page, see lower part of page 226.



Precision jig grinder introduced by Hauser Machine Tool Corporation

Hauser Precision Jig Grinder

A precision jig grinder designed to combine extreme accuracy with exceptional output is being placed on the market in this country by the Hauser Machine Tool Corporation, Manhasset, N. Y., U. S. factory representative of Henri Hauser, Ltd., Bienne, Switzerland. This new Model 3S grinder has a capacity for grinding work up to 5 inches in diameter, and is capable of doing a wide range of toolroom work.

The interchangeable spindle unit, incorporating automatically lubricated precision ball and roller bearings, is driven by compressed air. By adjustment of the air-line pressure, spindle speeds up to 75,000 R.P.M. are obtainable. Bores are ground by the planetary motion spindle principle. Both small and medium-sized holes are ground with the normal high-speed grinding spindle, while larger holes are ground with a special offset grinding head having eccentric adjustment.

Provision is made for grinding taper holes with an included angle up to 3 degrees for a length of 2 5/16 inches, and with somewhat smaller angles for lengths up to 3 9/16 inches. Settings for the amount of taper are made by direct reference to a scale.

To facilitate gaging and inspection of the work during grinding, spindle rotation and reciprocation can be stopped and the spindle raised to clear the work. A dial indicator for depth measurements, reading to 0.001 inch, facilitates grinding blind holes accurately to depth.

The table has a working surface of 22 by 12 3/4 inches, a longitudinal travel of 16 inches, and a transverse travel of 10 inches. Coordinate settings are made by means of ground-thread leadscrews fitted with highly accurate pitch-correction devices.

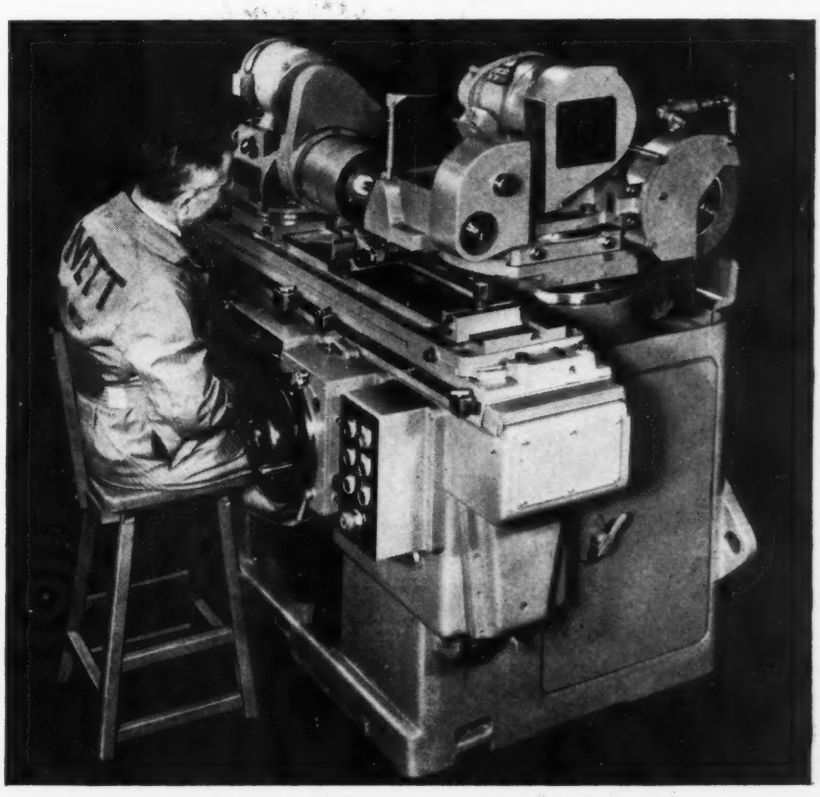
Precision dividing drums and verniers reading to 0.0001 inch are protected by glass windows and are electrically illuminated. Provision is made for locking the slides when settings have been made. The size of the machine is 80 by 48 by 44 inches, and the weight 2450 pounds. 63

Rivett Universal Hydraulic Grinder

A universal hydraulic grinder designed to perform all the internal and external grinding work encountered in the average toolroom has just been added to the line of precision machine tools built by Rivett Lathe & Grinder, Inc., 22 Riverview Road, Brighton, Boston, Mass. The general work range of the new No. 1024 grinder includes the grinding of holes from 1/8 inch to approximately 9 inches in diameter and up to 8 inches in depth, and external grinding of parts up to 12 inches in diameter by 18 inches long. Straight, taper, two-angle, face, and shoulder surfaces can be readily ground. Work can be held in a collet, step chuck, or jaw chuck, on a faceplate, or between centers.

New features developed to reduce set-up time include a double-end wheel-head which swivels 180 degrees for positioning the external or internal wheel for grinding. The internal spindles are available with extension arbors or with solid extension for deep holes with speeds from 6000 to 35,000 R.P.M. A 12- by 1 1/2-inch face wheel can be mounted on either end of the spindle.

All grinding spindles are cartridge type, flange-mounted, with anti-friction bearings which are grease sealed for life. The workhead spindle has infinite speed adjustment. Collets and step chucks are mounted directly in the spindle to assure accurate positioning and quick gripping of the



Universal hydraulic grinder built by Rivett Lathe & Grinder, Inc.

To obtain additional information on equipment described on this page, see lower part of page 226.

work. A standard 5-inch sine bar measures the swivel angle of the work-head or table for accurate taper grinding. Micrometer table stop, fine feed for compensating wheel wear, and hydraulic table control are features incorporated in the new grinder. 64

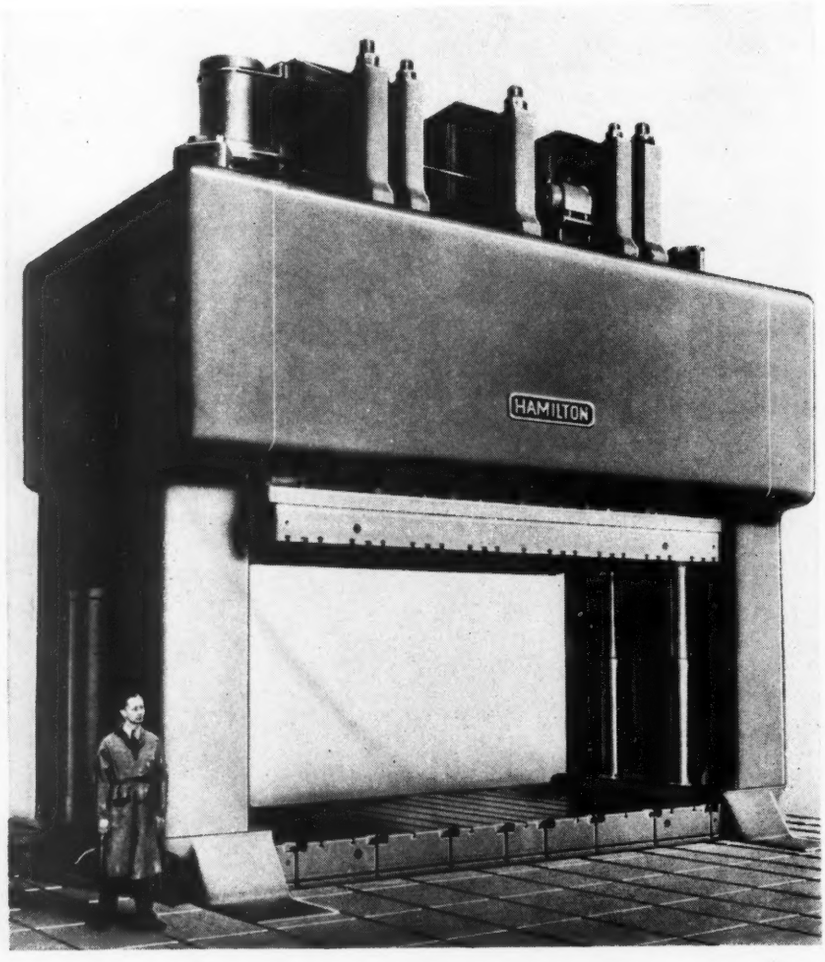
Lima-Hamilton High-Speed Triple-Action Press for Drawing Automobile Body Roofs

The Lima-Hamilton Corporation, Curtis Bldg., Detroit, Mich., has introduced a new giant-size, high-speed, triple-action drawing press, designed for stamping out the roofs of automobile bodies. This press is said to increase the production of roof stampings 75 per cent, compared with the production obtained with equipment now in use.

Dies up to 200 inches long can be used on this press for drawing work to a depth of 24 inches. The drawing speed is about 70 feet per minute, and the press operates at the rate of six strokes per minute. Since the plunger slide is in the bed and travels upward when making the draw, the roof stamping for an automobile body comes out of the die right side up, so that it does not need to be turned over for the subsequent trimming operation. The press, together with the dies, weighs over 600 tons. 65

SKF Unit Type Pillow Block

An improved unit type of antifriction bearing pillow block that holds fast to shafts revolving at high speeds with a vise-like grip has been developed by S K F Industries, Inc., Philadelphia 32, Pa., for a wide range of industrial applications. The new pillow block, equipped with either ball or spherical roller bearings, is designed with a tapered inner ring, tapered split sleeve, and tightening nut for securely clamping the sleeve around the shaft. It is available in shaft sizes from 1 7/16 to 2 7/16 inches. 66



Lima-Hamilton giant-size, high-speed, triple-action press for drawing tops for automobile bodies

"American" Hydraulic Roll-Duplicating Lathe

The American Tool Works Co., Pearl St. at Eggleston Ave., Cincinnati 2, Ohio, has developed a new hydraulic roll-duplicating lathe for producing rolls of the shape required in steel rolling mills. It is claimed that this lathe will reduce the machining time from 50 to 85 per cent over former methods and produce a smooth surface finish on the rolls that requires no subsequent finishing operations.

With this machine, a chilled iron roll such as shown in the illustration, having a scleroscope hardness of 65, can be completely finished from the blank in six hours, three and one-half hours being required for roughing, and two and one-half hours for finishing. This is accomplished without any appreciable tool wear. Methods previously employed required thirty hours for roughing and four hours for finishing.

The outstanding feature of this equipment is the dual-slide hydraulic duplicating mechanism for controlling the cutting tool as it reproduces from a templet the desired roll shape on either chilled iron or steel roll blanks. The mechanical feed, through the conventional quick-change gear mechanism, is continuous, while the tracer-controlled angular slides give stepless generation of the contours, which is largely responsible for the high degree of accuracy and finish obtained. Standard round-nose, cemented-carbide cutting tools are used for both roughing and finishing. The 40-H.P., constant-speed motor and the rigid construction of the lathe provide the power and strength necessary for machining rolls up to 26 inches in diameter.

The two slides, one of which is superimposed on the other, are mounted at an angle of 45 degrees to the work axis and at 90 degrees to each other. The cutting tool is mounted on the upper slide. With this combination of slides, any conceivable roll shape can be generated. The slides have nitrided

To obtain additional information on equipment described on this page, see lower part of page 226.

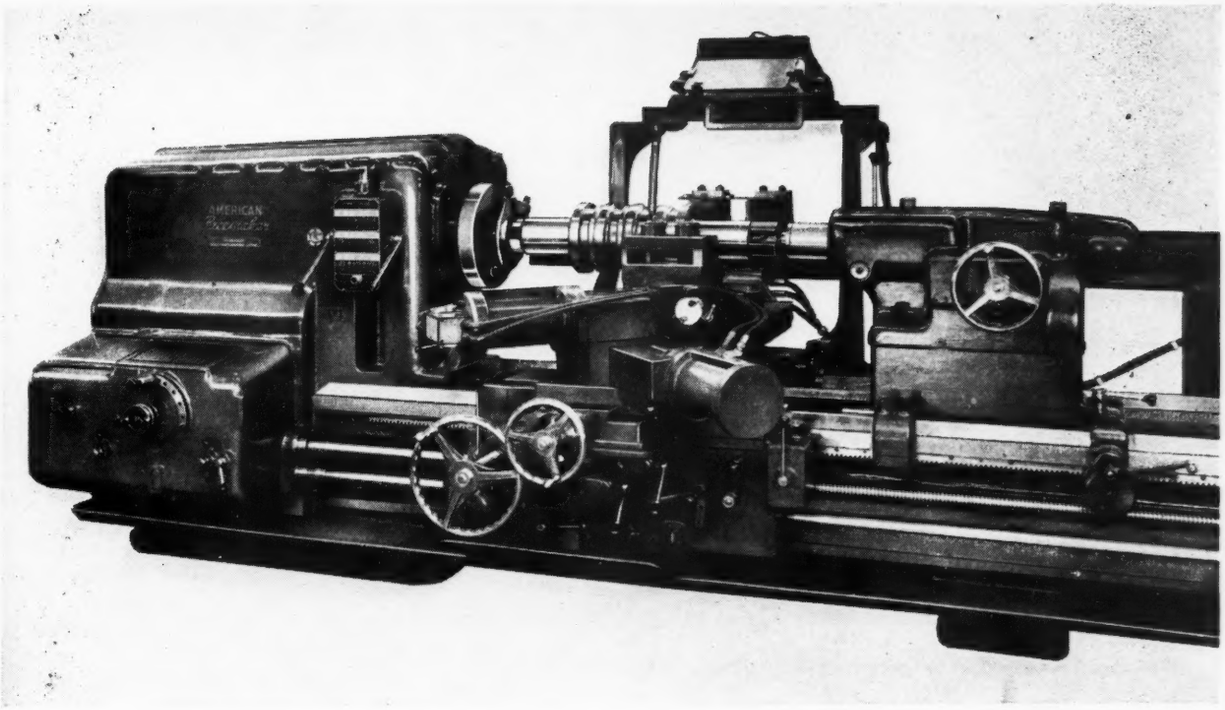


Fig. 1. Hydraulic roll-duplicating lathe brought out by the American Tool Works Co.

guideways to insure permanent accuracy.

The hydraulic duplicating mechanism consists of a motor-driven pump, which supplies 300 pounds per square inch pressure, and a tracer valve, which meters the oil directly to the cylinders that control the movements of the slides that support the cutting tool.

A micrometer dial, graduated in thousandths of an inch, and reading directly on the work diameters, is located on the adjusting handwheel for accurately determining the diameters desired. Side positioning of the tool in relation to the roll blank is accomplished by the micrometer adjustable-templet support bar. A sensitive, manually controlled lever is provided for quick advance and retraction of the angular slides by power. An ingenious operational aid is provided by a compound clear vision mirror which shows the operator at a glance the exact relation between the templet and the stylus.

The headstock is of the conventional Pacemaker lathe design. It provides twenty-seven spindle speeds in close increments, with low speeds to accommodate form tools and high speeds for cemented-carbide turning tools. Hydraulic roll-duplicating lathes of this type are available for handling rolls of various sizes. 67

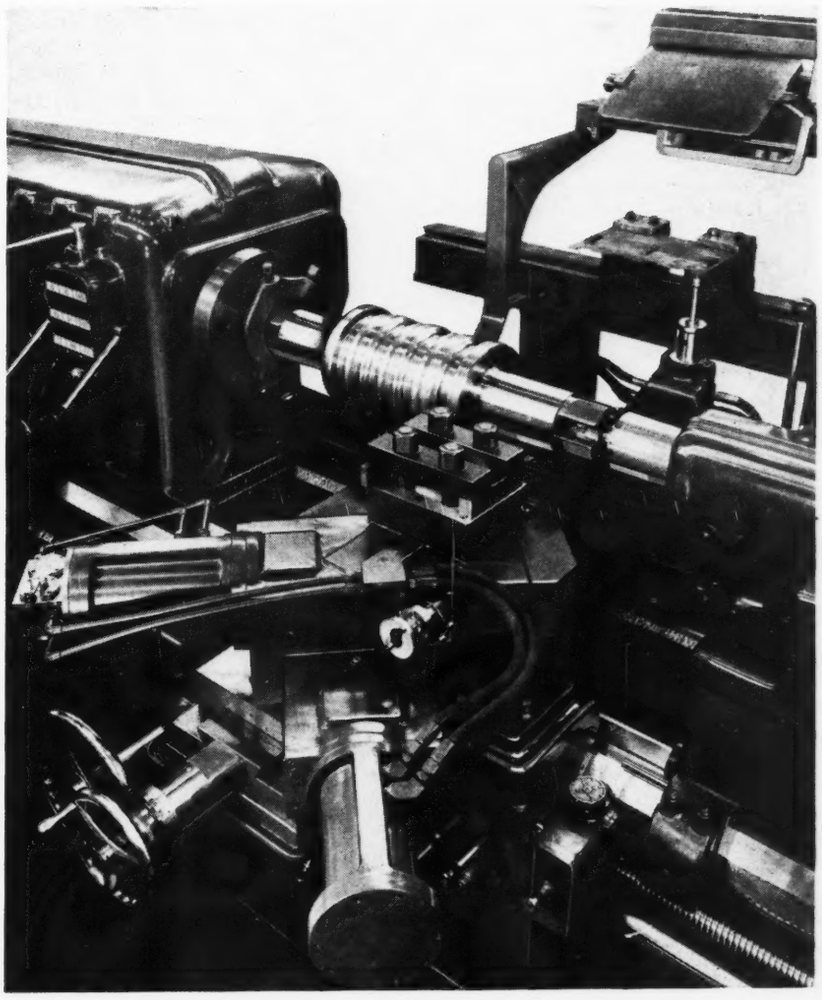


Fig. 2. Close-up view of work and tool equipment of lathe shown in Fig. 1

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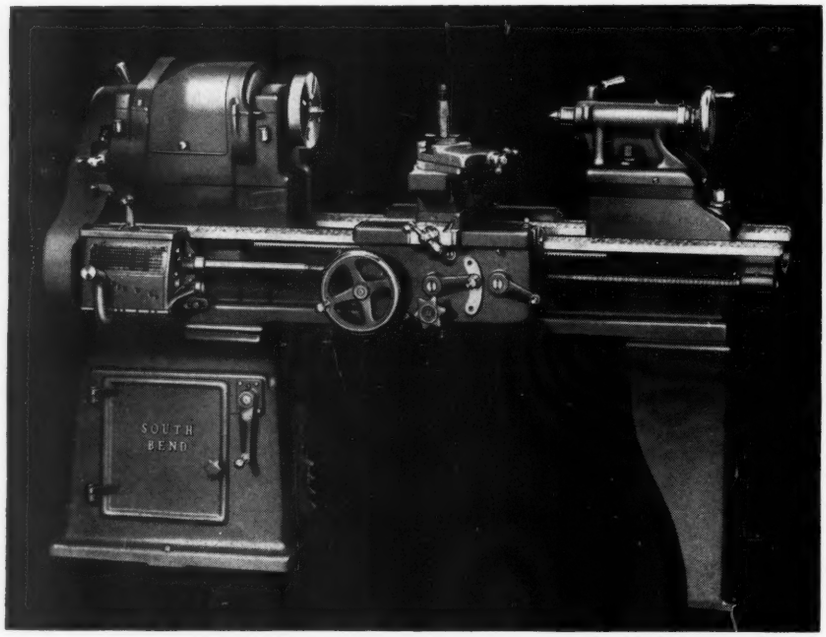


Large-swing lathe brought out by the South Bend Lathe Works

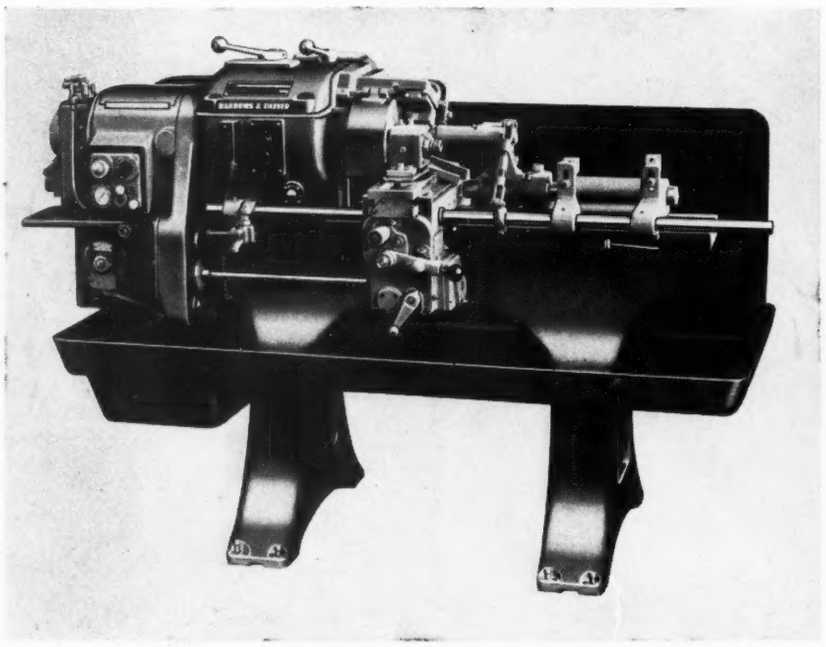
South Bend Large-Swing Lathe

A lathe designed especially for machining large-diameter work that is not excessively heavy has been brought out by the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind. This lathe has sixteen spindle speeds ranging from 11 to 727 R.P.M., which permits machining all work within the capacity of the lathe at efficient cutting speeds.

The maximum swing over the carriage is 24 1/4 inches, over saddle cross-slide with chip guard 18 3/4 inches, and over cross-slide without chip guard 19 1/4 inches. The distance between centers varies from 30 to 102 inches, depending on the length of the bed. Power longitudinal feeds range from 0.0015 to 0.0841 inch, and cross-feeds from 0.0006 to 0.0312 inch. Full quick-change gear mechanism provides for cutting screw threads of forty-eight different pitches, ranging from 4 to 224 threads per inch, either right- or left-hand.

This lathe is especially adapted for use in shops requiring a general-purpose precision lathe for handling large-diameter work, such as boring jig plates, turning and boring wheels, and machining pulleys, brake drums, and similar jobs. Although designed for large parts, it is not too heavy or cumbersome for efficient operation on small parts.

A two-speed 2-1 H.P. motor is mounted in the cabinet leg underneath the headstock. Power is transmitted by a belt through the lathe bed to the headstock cone pulley. Direct belt drive to the spindle prevents gear vibration at high speeds. Slow speeds are obtained through back-gears. A six-station motor control provides push-button selection of high and low speeds, both forward and reverse. This permits changing quickly from low speed to high speed—a convenient feature when roughing and finishing cuts are taken with the same tool or when a large diameter and a small diameter on the same part are machined consecutively. The instant reversing feature also saves time on thread cutting and tapping operations. 68



Roller cutter type pipe-nipple machine developed by Bardons & Oliver, Inc.

Bardons & Oliver Roller Cutter Type Pipe-Nipple Machine

A single-spindle machine of the roller cutter type, designed to chamfer both ends of pipe nipples and cut off the parts at the rate of 100 or more per minute, has been developed by Bardons & Oliver, Inc., 1133 W. 9th St., Cleveland 13, Ohio. The anti-friction bearing, all-geared, alloy-steel headstock provides six quick speed changes from 560 to 2280 R.P.M. for handling all sizes of pipe nipples from 3/8 inch to 1 1/2 inches.

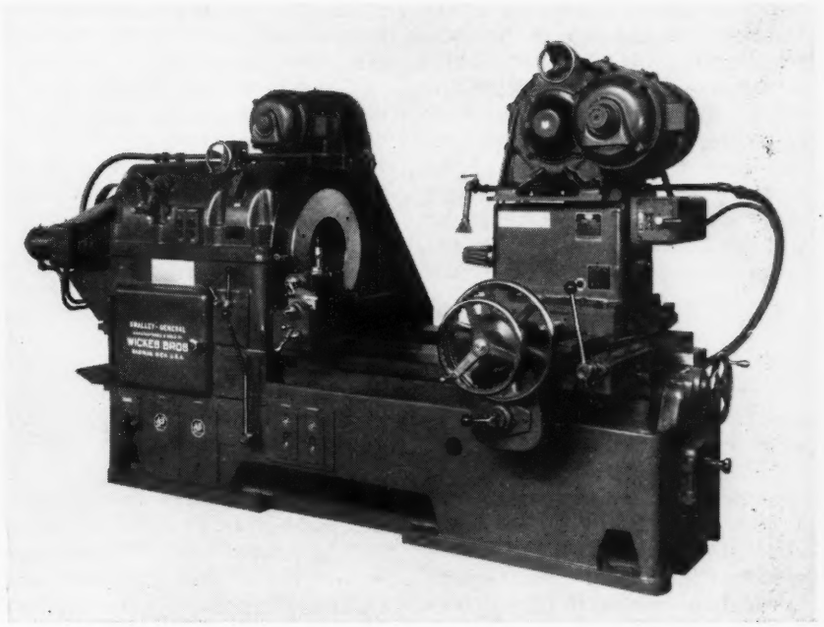
The patented roller pipe feed permits automatically cutting and chamfering all lengths from 1/4 inch to 12 inches. Longer lengths can also be produced by semi-automatic operation of the machine. The machine can be equipped with a 3 3/4-, 5-, or 7 1/2-H.P. motor. It requires a floor space of approximately 39 by 88 inches, and weighs 2500 pounds. 69

To obtain additional information on equipment described on this page, see lower part of page 226.

Thread Miller for Large-Diameter Work

A No. 30 Smalley - General thread miller employing a multiple-ring tooth cutter for milling internal and external, straight and tapered, right- and left-hand threads has been announced by Wickes Brothers, Division of the Wickes Corporation, Saginaw, Mich. Threads having any taper up to 4 inches per foot and within the range of one to twenty-eight threads per inch can be milled by this new machine, which has a swing over the bed of 30 inches. Large-diameter work is easily handled with the 10 1/2- or 15 1/2-inch hydraulically operated three-jaw wedge chuck. The machine can be equipped with a four-jaw independent chuck or a faceplate with boring mill jaws if desired.

The milling spindle speeds range from 50 to 300 R.P.M., and the main spindle makes one revolution in 1.52 to 41 minutes for milling and 3.08 to 83 revolutions per minute for turning. The worm and gear drive to both spindles and the gear-box are immersed in a bath of oil. The hardened steel ways on the cast-iron bed are power lubricated, and all shafts and spindles run in anti-friction bearings. Various parts subject to wear, such as the lead-screw nut, have provisions for adjustments. Special attachments, including outboard bearings for long work, a turning and facing slide, and a tailstock, are also available. 70



Smalley-General thread milling machine announced by Wickes Brothers

Cross Special "Transfer-matic" Designed for Finishing Operations on Cylinder Blocks

The Cross Company, Detroit 7, Mich., recently announced a special "Transfer-matic" machine developed for use in machining cylinder blocks in engine-building plants of moderate production capacity. Forty-five individual finishing operations are performed on this machine, which requires only one unskilled operator. Seven crankshaft and four camshaft bearings are rough-bored, the oil gallery hole is drilled completely, twenty-one holes in the front face of the block and ten holes in the rear face are drilled, and two locating holes in the rear face are reamed on the machine. The machine was designed to meet production requirements of thirty-five cylinder blocks an hour.

The transfer mechanism automatically carries the work from station to station. The parts are positioned at each station by power elevators, and are automatically secured by individual clamps. Seven stations are provided — a loading station, five working stations, and an intermediate station equipped for inspecting the work.

The Transfer-matic is made up of standard Cross sub-assemblies in order to provide flexibility for part design changes and simplify maintenance. Other features include hydraulic feeds and automatic push-button control working cycle. 71

"Transfer-matic" developed for rapid finishing of cylinder blocks by The Cross Company

Dayton-Rogers Punch Press Safety Guard

A universal punch press safety guard designed to prevent the work cycle of the press from being started except by placing both

To obtain additional information on equipment described on this page, see lower part of page 226.

hands on the safety guard levers has been brought out by the Dayton Rogers Mfg. Co., 2824 Thirteenth Ave. South, Minneapolis 7, Minn. This two-handed safety principle eliminates all possible accidental treadle tripping of the power press because pressure on either one of the hand-levers alone will not trip the press. After the press passes through one work cycle, the non-repeat mechanism automatically prevents repeated cycling of the press.

The trip mechanism in no way obstructs the working areas or vision at the point of operation. Installation is simplified by using flexible push-pull type cables to actuate the various mechanisms instead of conventional linkage devices. 72

Snyder Special Vertical Hydraulic Lathe

A special heavy-duty, vertical hydraulic lathe, designed to develop maximum efficiency in the application of carbide tooling, has recently been built by the Snyder Tool & Engineering Co., Detroit, Mich. Although designed for a specific application, this machine is widely adaptable to facing, boring, or turning a variety of large work-pieces simply by changing the fixtures and tool-holders.

The vertical welded steel column carries a hydraulically operated horizontal cross-slide upon which are mounted two hydraulically operated vertical tool-slides. Each tool-slide is equipped with T-slots and keyways for mounting tool-blocks and holders. The horizontal slide has a 21-inch stroke, and the vertical slides have a 14-inch stroke. These slides can be replaced with slides having strokes up to 27 and 20 inches, respectively.

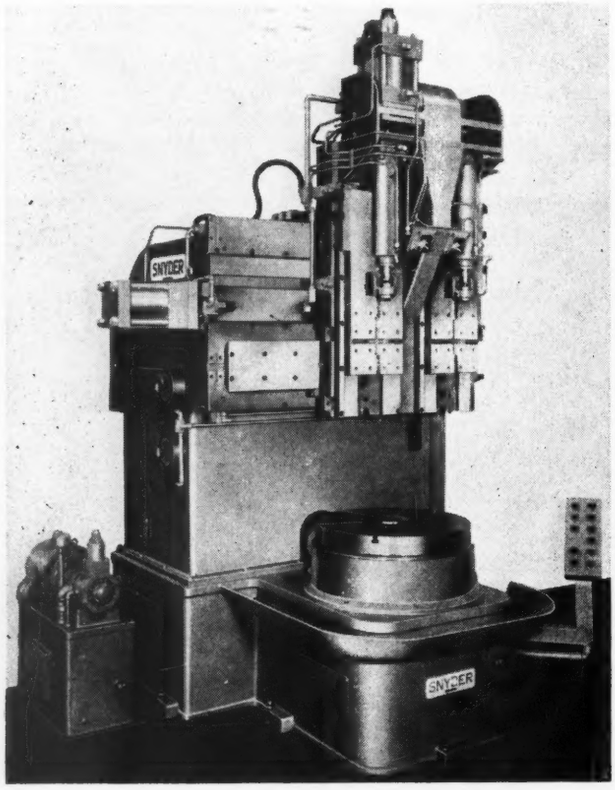
A 30-inch variable-speed, rotating table is mounted on the base, and is equipped with T-slots and a pilot for attaching fixtures and chucks. The table is mounted in preloaded Timken bearings, and is driven through spiral, bevel, and helical gears. Power is supplied by a 15-H.P. motor. Speeds from 46.5 to 185 R.P.M. are available. The machine can be set for various combinations of automatic cycling. The base is of welded, heavily reinforced steel construction, and houses a large chip and coolant tank. The floor space required by the complete machine is 70 by 100 inches. 73

Bliss Press Equipped to Compress and Size New Rivetless Brake Lining

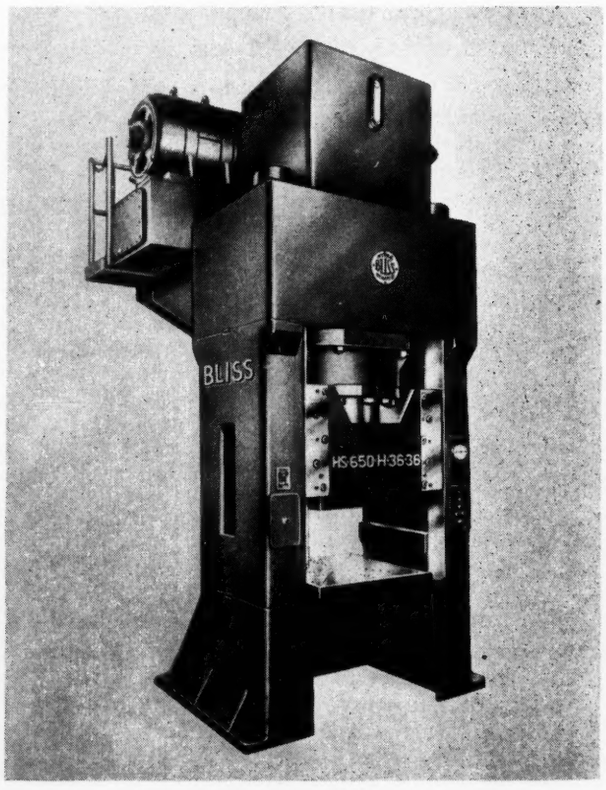
A new series of hydraulic presses of simplified design has been developed by the E. W. Bliss Co., 1420 Hastings St., Toledo 7, Ohio. The first of the new series—a 650-ton single-action press—is representative of the new standards that apply to both single-action and double-action types of this line. This particular press, which is shown in the illustration, is being used for compressing and sizing the new rivetless type of brake lining for automobiles.

Lower initial costs, lower maintenance cost, smoother and quieter operation, and increased production are advantages claimed for the new presses as a result of a simplified hydraulic circuit and the use of a dual flow pumping system; major reduction in the amount of piping and valves; unit design of frame, cylinder, and slide; prestressed tie-rod frame; four adjustable flat type Meehanite gibs with removable wear strips on the uprights; foot-valve directly connected to cylinder; no interconnecting piping; and open type prefill valve.

The pump design permits re-



Special vertical hydraulic lathe brought out by Snyder Tool & Engineering Co.



New 650-ton single-action hydraulic press brought out by the E. W. Bliss Co.

To obtain additional information on equipment described on this page, see lower part of page 226.

versing of the oil flow and provides a controlled gravity descent with smooth starting and stopping, as well as smooth release of pressure at the end of the pressure stroke with no shocks or surges. Front uprights are made straight to facilitate loading the work on a truck. 74

H-P-M Giant Size Double-Action Deep-Drawing Press

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, recently built a 2000-ton double-action hydraulic press with die cushion and blank-holder for installation in the plant of the Caterpillar Tractor Co., where it will be employed for deep-drawing, forming, and blanking operations on large tractor parts. This press weighs 385,000 pounds, is 24 feet high, and requires a pit 10 feet deep to house the part normally extending below the floor level. With this machine, parts up to 16 inches deep can be drawn from extra heavy gage metal.

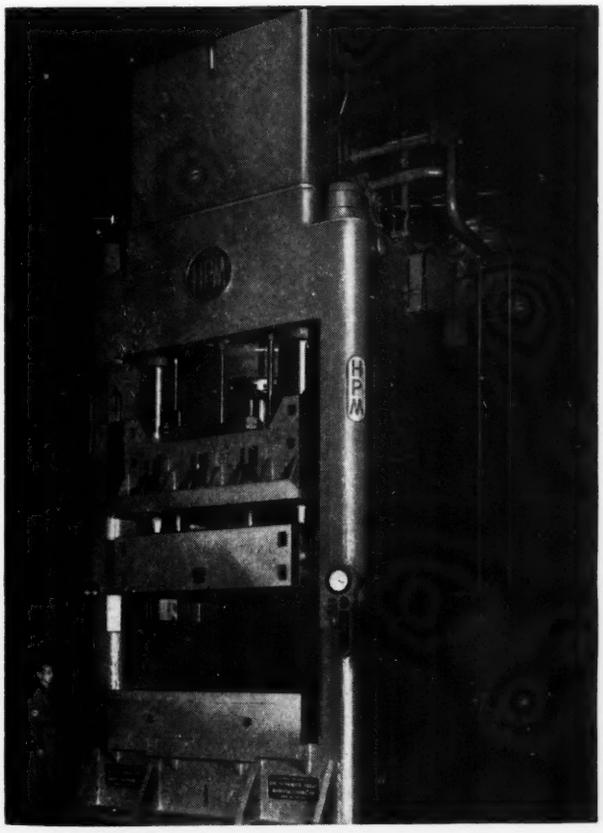
The bolster plate which covers the bed of the press is 15 inches thick and weighs 48,300 pounds. The maximum die mounting surfaces are 96 by 96 inches. The hydraulic blank-holder and the hydraulic die cushion in the bed each have a capacity of 500 tons. Outstanding features include adjustable blank-holder pressure at each of the four corners of the slide; rapid advance with automatic slow-down just before the die contacts the work; automatic press cycle with push-button control; and automatic press reversal through the closed-circuit operating system. 75

"Pant-O-Scriber" for Checking Punch and Die Contours

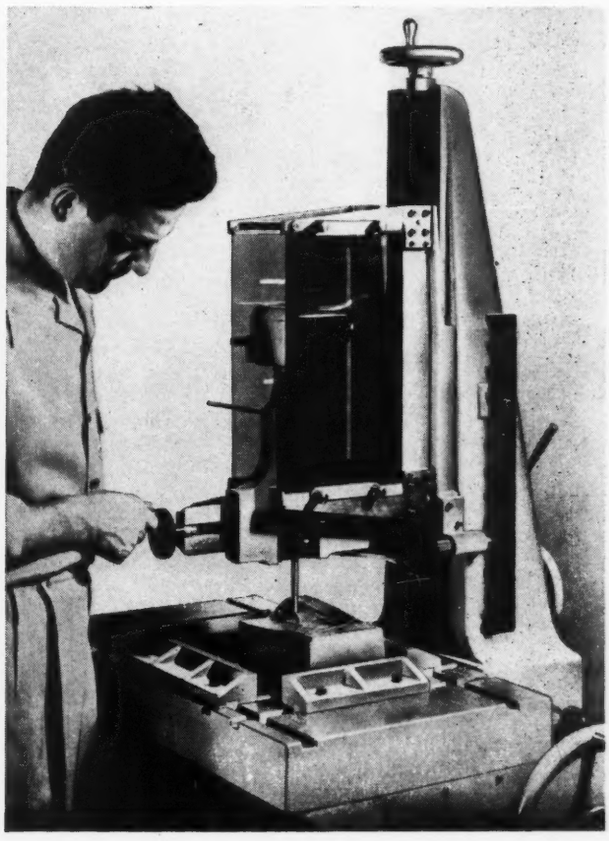
The Engineers Specialties Division, Universal Engraving & Colorplate Co., Inc., 980 Ellicott St., Buffalo 8, N. Y., has announced a machine for checking the contour profiles, flash, and striking surfaces of forging dies and punches. This machine, known as the "Pant-O-Scriber," for which patents are pending, can also be employed for checking the contours of cams and other parts.

The die-checking machine has a table on which a forging die or punch of any size up to 22 inches long, 14 inches wide, and 12 inches thick, weighing up to 800 pounds, can be positioned for checking. At the rear of the table is a column on which holders are provided for two glass plates, mounted in parallel, vertical planes at each side of the scribing mechanism. The inner sides of the glass plates are coated with red or green films. A scribing cutter-head located between the two glass plates is attached to the upper end of an arm which carries a tracing stylus at its lower end. When the stylus is traversed over the profile of the punch or die, its movements are duplicated by the scribing cutter-head.

A motor-driven spindle extending through the cutter-head at right angles to the inner coated surfaces of the glass plates is provided with a scribing cutter at each end. These scribing cutters have exactly the same radius as



Huge double-action hydraulic deep-draw press built by the Hydraulic Press Mfg. Co.



"Pant-O-Scriber" for checking the contours of dies, punches, and other formed parts

To obtain additional information on equipment described on this page, see lower part of page 226.

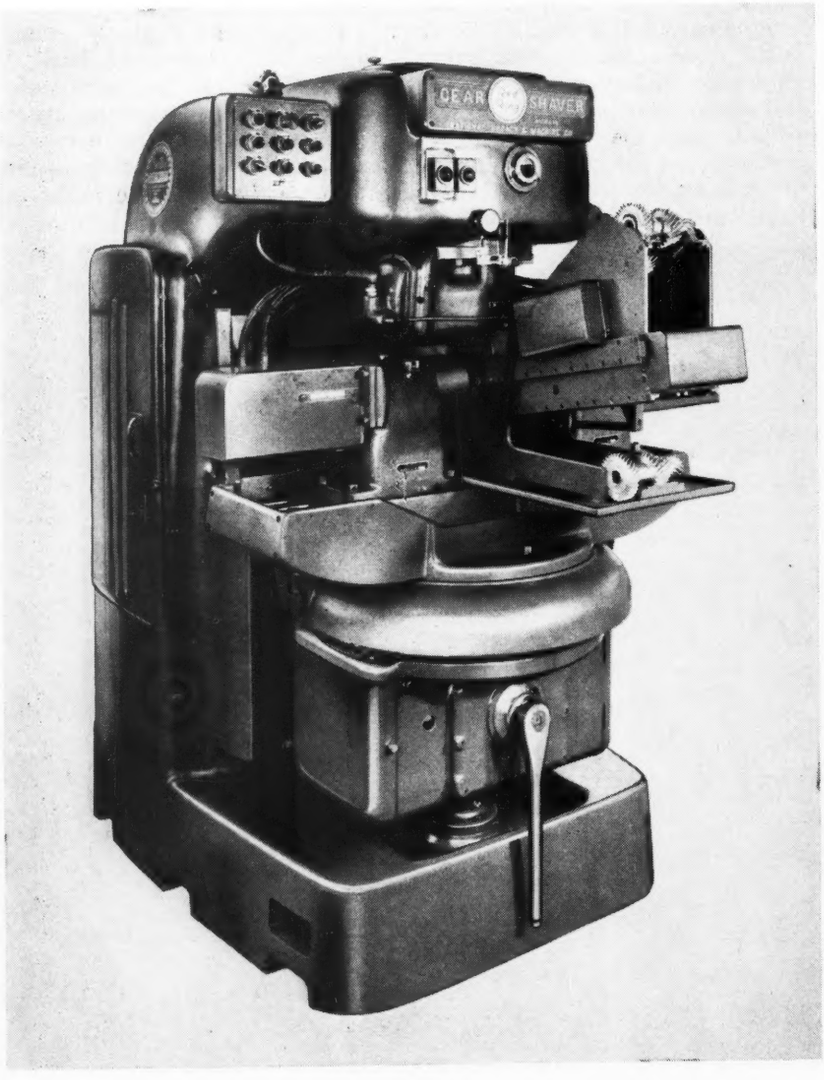
the tracing stylus. Either cutter can be brought into contact with the red- or green-coated side of its respective glass plate. The cutter will then scribe a contour profile which duplicates the contour profile of the section of the die or punch traced by the stylus.

In the particular set-up illustrated, the contour profile of one-half of the die mounted on the table is being traced and duplicated by the scribing cutter in the colored film on the glass at the right-hand side of the scribing head. After scribing the contour profile for one section of the die, the column carrying the scribing head is indexed to the next gaging position by means of gage-block settings. The glass is also indexed a known distance vertically for scribing the second contour profile on the same glass. The glass indexing arrangement provides for scribing up to nine contour profiles on one glass. The same procedure can be employed in scribing contours on the glass at the left-hand side of the scribing head. With this arrangement, the contour profiles of matching punches and dies can be scribed on red- and green-coated glass for comparison and checking.

For accurate checking, the glass plate with the scribed contour profile is removed from the "Pant-O-Scriber" and placed in register with a master chart of contrasting color in the measuring stage of a vertical "Vu-graph Delinescope." Any area can be accurately measured by means of dial indicators and adjusting screws, which are used to move the upper contour profile glass in the measuring stage while the lower glass remains stationary. 76

Automatic Loaders for Gear-Shaving Machines

Automatic loaders for gear-shaving machines, originally developed by the National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich., to reduce the cost of shaving operations on small pinion gears, are now available for handling all types of external transmission gears, including cluster and stem gears.



Gear-shaving machine with automatic loader for transmission cluster gears brought out by National Broach & Machine Co.

Gear-shaving machines equipped with these automatic loaders can be run continuously as long as the magazine is kept filled with work. One operator, who need not be a skilled machinist, can easily keep the magazines of several automatic loaders filled, so that all the machines can be kept running continuously.

The Model GCU diagonal gear-shaving machine and automatic loader shown in the illustration is set up for shaving a 32-tooth constant-mesh transmission gear at the end of a cluster. This helical gear has a 3.765-inch pitch diameter, 10.5 diametral pitch, and a 5/8-inch face. The blank has an over-all length of 5.809 inches and a 0.875-inch diameter broached hole extending throughout its entire length. The actual floor-to-floor time for this operation is sixteen seconds. Three smaller gears of this cluster can also be shaved on the machine at comparable production rates, using the same loader and simply changing the set-up. 77

Portable Air Compressors

Two low-cost, dual-pressure, portable air compressors have just been announced by the Kellogg Division of the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y. Both of these piston type compressors offer two working pressures and two air deliveries by merely shifting a lever. The Model B-140-DS compressor, shown in Fig. 1, is driven by a 1/2-H.P. electric motor, and the Model G-140-DS, shown in Fig. 2, is driven by a 3/4-H.P. gasoline engine. Both models operate at 150 pounds pressure and deliver 2.4 cubic feet of free air per minute for operating a grease gun, tire inflating, and many other uses requiring high pres-

To obtain additional information on equipment described on this page, see lower part of page 226.

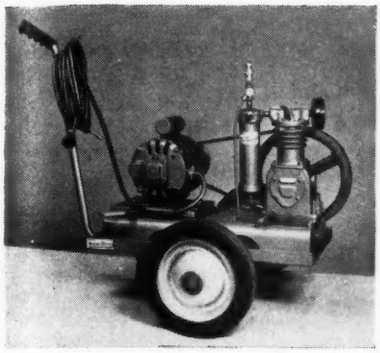


Fig. 1. Portable air compressor with electric motor drive

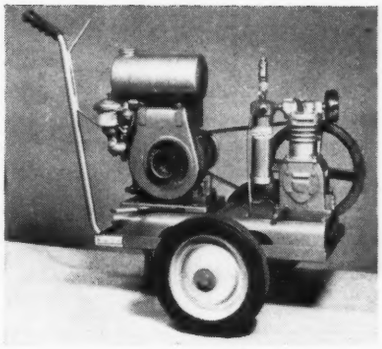


Fig. 2. Portable air compressor with gas-engine drive

sure. The compressors can also be employed as continuous-running units at 50 pounds pressure, delivering 3.2 cubic feet of free air per minute for work that requires low pressure and increased volume. 78

Johnson Inclinable Press

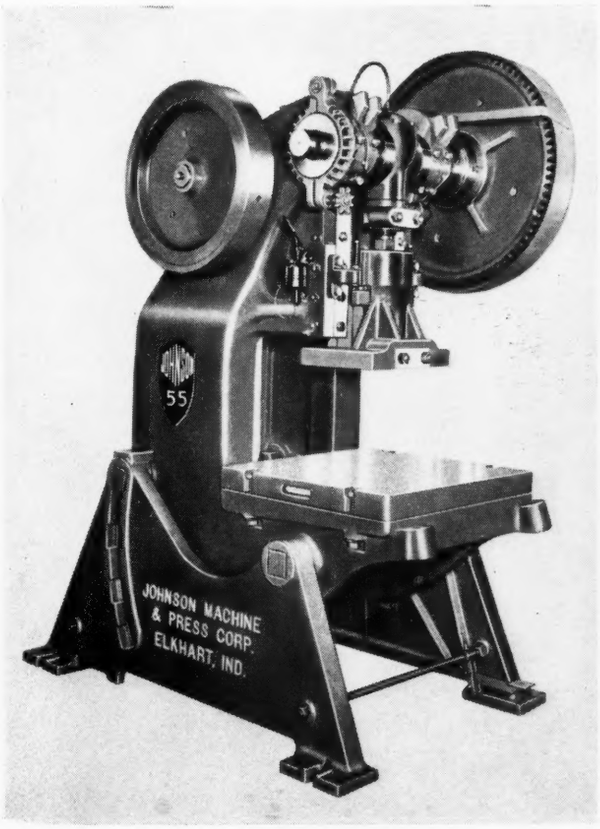
An inclinable press designed to handle a wide range of work is a recent product of the Johnson Machine & Press Corporation, Elkhart, Ind. This Model 55 press has a 32- by 34-inch bolster plate, a ram face measuring 14 by 18 inches, and an unusually large die space with a 14- to 18-inch opening. The bed of the press has been strengthened considerably, and has a 20-inch opening through the back. An interchangeable thin steel bolster is available, which provides a still greater die space without sacrificing strength.

The press will handle work up to 16 3/4 inches deep at the rate of forty-five pieces per minute, either in the vertical position or tilted at any angle up to 36 degrees. A patented tripping device protects the operator in the event of spring breakage. 79

Graham Stud-Welder

The Graham Mfg. Corporation, 1541 E. Eight Mile Road, Ferndale 20, Mich., has recently added a single-gun machine to its line of welding equipment. This welder has a capacitor-operated, self-timing device using tip studs. The studs, on coming in contact with the work and fusing, cause ionization, which, in turn, provides a path for the main discharge current of the capacitor, forming an arc of sufficient capacity to melt both the full area of the stud end and the work-piece area directly under it. This melting action is followed by the necessary hammer blow which causes the pieces to be welded together. The complete cycle is brought about by a rapid continuous movement of the stud-holding part, no retarding means being employed.

Some of the metals and alloys that can be welded with this equipment are stainless steel, Monel, aluminum, magnesium, zinc, and copper. The machine has a capacity for studs up to 1/2 inch in diameter. Mechanical or pneumatic welding pressure can be used. No auxiliary cooling means is necessary. 80



Inclinable press made by the Johnson Machine & Press Corporation

Stud-welding machine brought out by the Graham Mfg. Corporation

To obtain additional information on equipment described on this page, see lower part of page 226.

Baird Four-Spindle Vertical Continuous Lathe

A 5-inch automatic continuous type four-spindle vertical lathe in which each spindle has its own individual set of cutting tools is a new product of the Baird Machine Co., 1700 Stratford Ave., Stratford, Conn. End-mills adapted for face milling the shank of a slip yoke and chamfering the hole are mounted on the cutter-bar of the particular machine illustrated, alternate spindles being set up to machine different sizes of work. As the spindle-carrier in which the four work-spindles and the four cutter-bars are mounted makes one revolution in fifteen seconds, a completed piece is delivered every 3.75 seconds, giving a production of 900 pieces per hour, or 450 pieces per hour of each of the two sizes.

With a work-spindle speed of 496 R.P.M. and a work stroke of 1/4 inch, the performance figures are: Feed per revolution, 0.0076 inch; cutting speed for end facing, 213 feet per minute; and cutting speed for chamfering, 160 feet per minute. Approximately 3/32 inch of stock is removed from the work. Each work-spindle is disengaged automatically as it approaches the loading position. A swivel joint in each work-holding fixture permits the fixture to be swung out for loading and unloading. The swivel joint is operated manually by the operator, and if for any reason it is not returned to its upright position, a safety device, interlocked with the motor control, stops the machine.

Coolant is supplied to the work either from an individual tank or from a centralized system. Chips are washed out through a discharge chute at the back of the machine, where the coolant is strained and returned to the tank. The machine requires a floor space 42 5/8 by 59 3/8 inches and is 76 inches high. 81

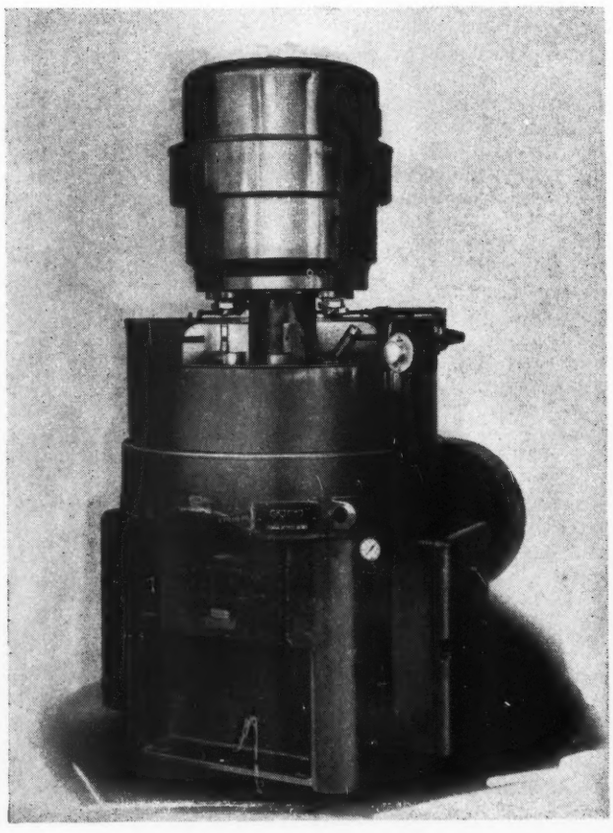
Swing Type Abrasive-Wheel Cut-Off Machine

Positive drive, flexibility, ease of operation, self-centering work-holding vise adaptable to most contours and shapes, and safety of operation are features of a new low-priced "Swing-Cut" abrasive-wheel metal cut-off machine manufactured by the Stone Machinery Co., Inc., 340 Fayette St., Manlius, N. Y. This machine has a capacity for cutting up to 3-inch solids and 4-inch pipe in both ferrous and non-ferrous materials, using abrasive cut-off wheels up to 16 inches in diameter and a 5-H.P., 3500-R.P.M. geared-in-head motor.

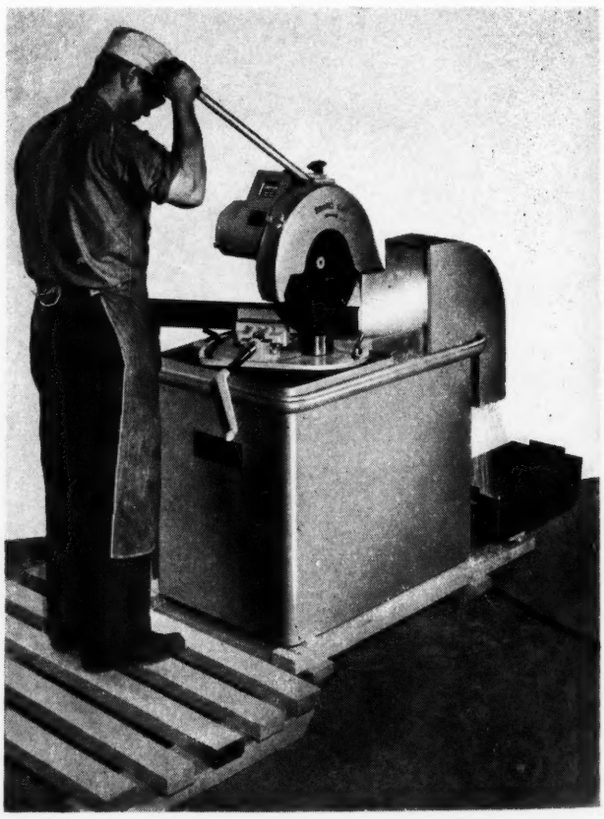
Rigid construction and positive work-holding means serve to increase wheel life and insure straight cuts to close tolerances with a minimum of burr. Work can be cut at speeds up to 2380 R.P.M. The machine requires a floor space of 2 1/2 by 4 feet, and weighs about 600 pounds. 82

Electrical Differential Speed Drive

Infinite speed ranges down to and including zero speed, with constant torque, under fully automatic control are obtainable with an electrical differential speed drive recently developed by Speed Control, Inc., 1344 Depot St., Wickliffe, Ohio. In the processing of web materials for example, constant tension or decreasing tension can be maintained between a machine and a winding



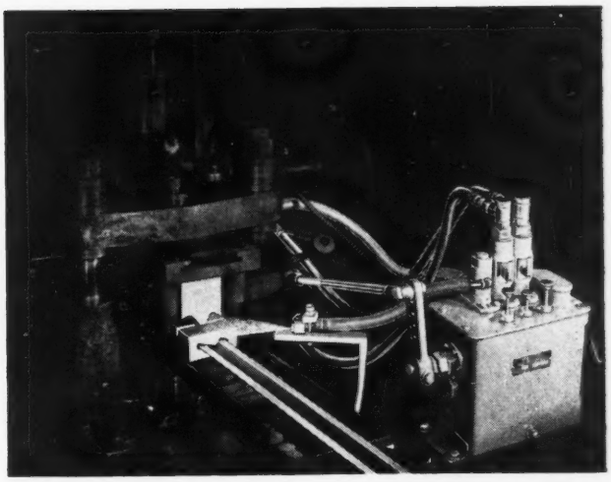
Four-spindle continuous vertical type lathe brought out by the Baird Machine Co.



Swing type, abrasive-wheel, metal cut-off machine manufactured by Stone Machinery Co., Inc.

To obtain additional information on equipment described on this page, see lower part of page 226.

Electrical differential speed drive brought out by Speed Control, Inc.



Spray lubricator made by Manzel, Inc., applied to punch and die work

stand or between two parts of the processing machine with this drive, thus assuring a smooth, even flow of the material.

The new drive, designated "Specon ED," consists of a standard alternating-current squirrel-cage motor of any desired voltage and frequency or any prime mover having a constant rotary speed, two direct-current motors and a differential gear-box. The alternating-current motor, or prime mover, is coupled with the two direct-current motors through the differential gear-box. The direct-current motors are connected in a closed circuit and require no outside source of power.

In operation, the direct-current motors run at varying controlled speeds within a 3 to 1 ratio range, and are the means of controlling the torque and unlimited speed range of the output shaft. The driving motor can be mounted either horizontally or vertically.

The unit is available in any required size and capacity. It is applicable to hoists, planers, textile machines, and other machines in the manufacturing field. 83

Manzel Spray Lubricator

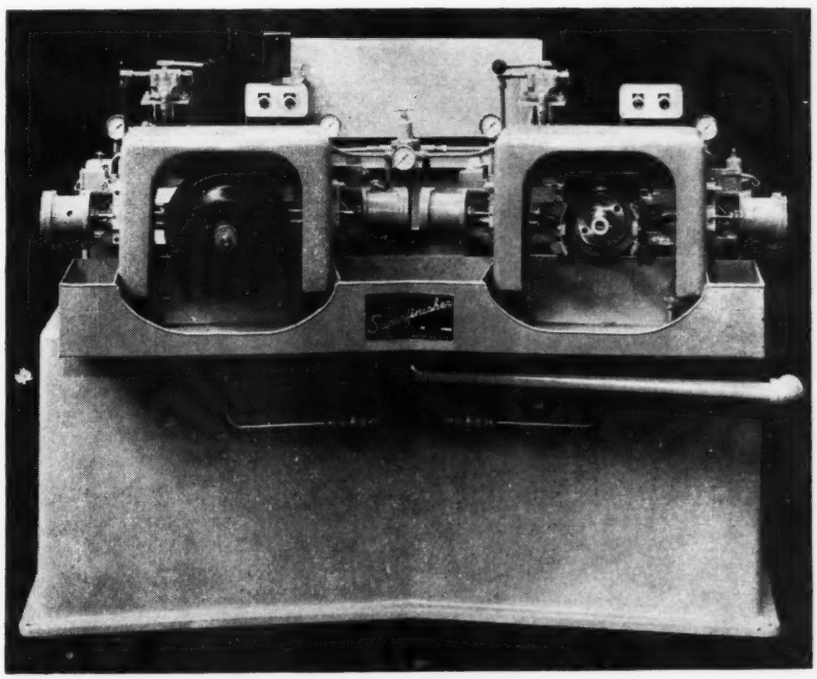
An automatic force-feed spray lubricator designed to spray punch and shear work intermittently with oil was announced recently by Manzel, Inc., 315 Babcock St., Buffalo 10, N. Y. The cleaner working and operating conditions resulting from the use of this lubricator are said to result in increased production, longer life for the dies, and reduced oil consumption.

Synchronized directly with the machines, the spray lubricators force automatically timed jets of oil mist directly on the punches and dies. The compressed air fed simultaneously into the sprayer nozzle with the oil has a cooling effect on the dies. 84

Gisholt Two-Spindle Brake-Drum Superfinisher

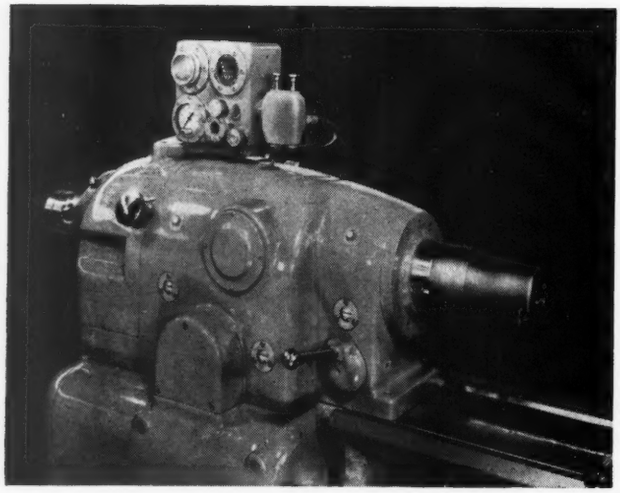
The Gisholt Machine Co., Madison 10, Wis., has designed a new two-station machine for superfinishing automotive type brake drums, which come to the machine turned to a surface roughness of approximately 150 micro-inches r.m.s., and are superfinished to 30 to 40 micro-inches r.m.s. With one operator, the production is over six brake drums per minute.

The spindles and controls are independent of each other. Each work station consists of a simple arbor and two sets of stones. The two roughing stones and the two finishing stones are timed together to work as the brake drum both oscillates and revolves. The movement of the stone-holders and the clamping of the workpiece are controlled by air. The complete spindle cycle is automatic. 85

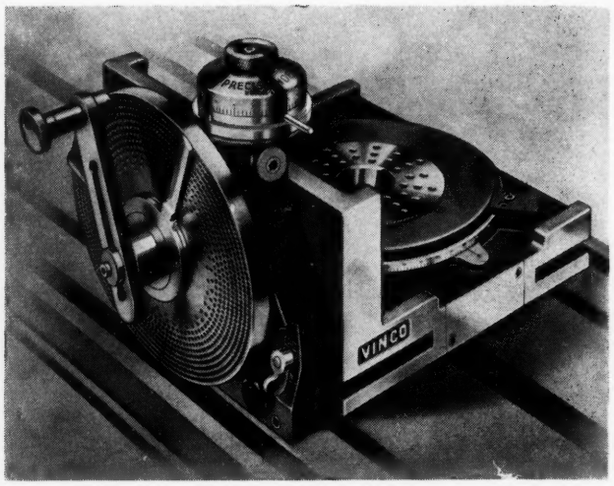


Gisholt two-spindle machine for superfinishing brake drums

To obtain additional information on equipment described on this page, see lower part of page 226.



Air-operated collect attachment developed for Monarch lathes



"Precisiondex" placed on the market by Vinco Corporation

Air-Operated Collet Attachment for Monarch Lathes

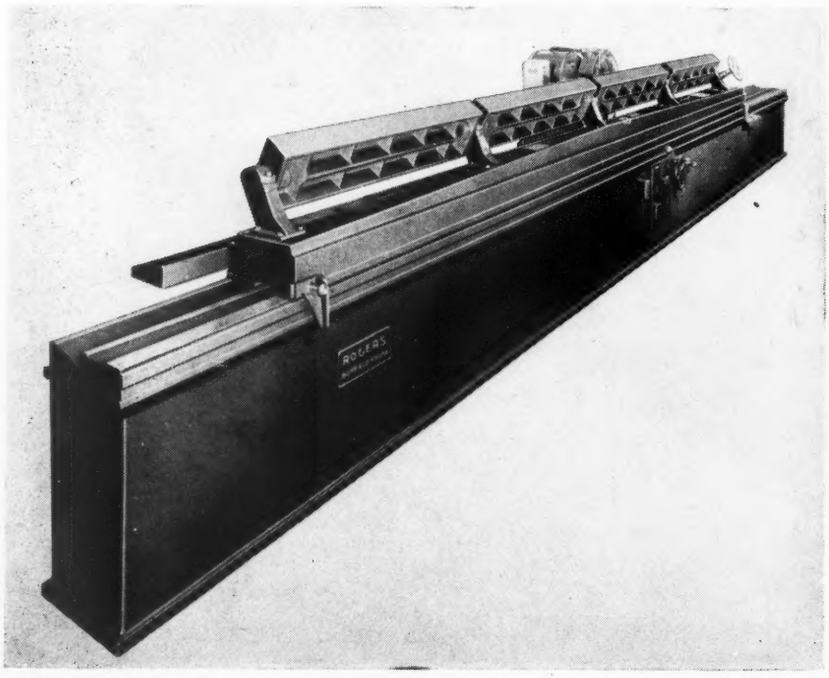
An air-operated collet attachment has been designed by the Monarch Machine Tool Co., Sidney, Ohio, to increase the output of its 10-inch precision manufacturing lathe and its "Speedi-Matic" hand-operated screw machine. The new collet design permits the use of a bar feed attachment. It is of the pusher type, like the lever-operated collet attachment previously supplied for these two lathes, and is intended to reduce operator fatigue on long production runs.

Two push-buttons in the headstock of the machine serve to control the new collet attachment. The operator simply presses one button to open the attachment, and the other button to close it. The attachment can be applied easily and quickly to the cam-lock spindle nose of either lathe. The collet adapter takes standard collets with capacities for handling round stock from 1/8 to 1 inch in diameter. 86

Vinco Precision Indexing Fixture

The Vinco Corporation, 9111 Schaefer Highway, Detroit 28, Mich., has brought out a work indexing fixture designed for highly accurate work. This fixture, known as the "Precisiondex," has a guaranteed indexing accuracy within 30 seconds of arc. It is adapted for jig boring and grinding, light milling, surface grinding, drilling, engraving, profiling, light shaping, graduating, inspection, and similar work.

Two side surfaces and the bottom of the fixture are flat and square within 0.0002 inch. The micrometer has a ratchet and pawl arrangement and clear-cut markings for making settings in seconds. The ratchet and pawl arrangement enables a predetermined number of seconds to be added consecutively to each indexing movement. 87



Heavy-duty machine developed by S. C. Rogers & Co. for grinding long knives

Rogers Heavy-Duty Grinder for Long Knives

A heavy-duty straight knife grinder 28 feet in length has recently been developed for end-to-end precision grinding by S. C. Rogers & Co., 191 Dutton Ave., Buffalo 11, N. Y. This 7-ton Model 220 grinder is designed to handle accurately and easily any heavy chipper knife, shear blade, or paper cutting knife up to 220 inches long. It is equipped with one 15-H.P. motor to drive the 20-inch segmental grinding wheel (or with a 10-H.P. motor for an 18-inch wheel) and one 3-H.P. motor to guide the traverse carriage. Extra wide 5-inch V-ways in base and carriage absorb grinding pressures and make possible heavy cuts and fast feeds without developing vibration.

A powerful jaw clutch transmission starts the table smoothly. The heavily slotted knife bars are

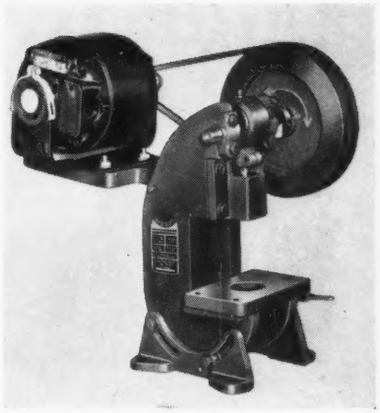
To obtain additional information on equipment described on this page, see lower part of page 226.

10 inches wide, but wider bars are available if required. Besides the 220-inch length, this machine is being manufactured in 90-, 100-, 110-, and 134-inch lengths. 88

Benchmaster "Midget" Punch Press

A low-cost "Midget" press having a capacity of "one ton plus" under continuous, heavy-duty operation has been added to the line of presses built by the Benchmaster Mfg. Co., 2952 W. Pico Blvd., Los Angeles 6, Calif. This smaller sized machine is designed to perform all conventional punch press operations, such as punching, shearing, staking, riveting, forming, coining, etc. It has a regular stroke of 3/4 inch, but is available with shorter strokes on special order.

The ram has a 3/4-inch hole, and operates at a speed of approximately 290 strokes per minute when driven by a 1725-R.P.M. motor. A positive single-trip safety mechanism is provided which can be set for repeat operation by removing one screw. The ram dovetail is gibbed for wear adjustment and the ram screw is threaded to provide for an adjustment of 1 inch. The crankshaft has replaceable bronze bushings.



"Midget" punch press brought out by the Benchmaster Mfg. Co.

The bolster plate is 4 by 6 inches by 5/8 inch, and has a 1 3/4-inch hole in its center. The die space with the ram up is 3 3/4 inches and the throat depth 2 1/8 inches. The height of the press is 17 1/2 inches, and the weight 65 pounds. 89

Cleveland Tramrail Vertical Stacking Hairpin Hook and Carrier

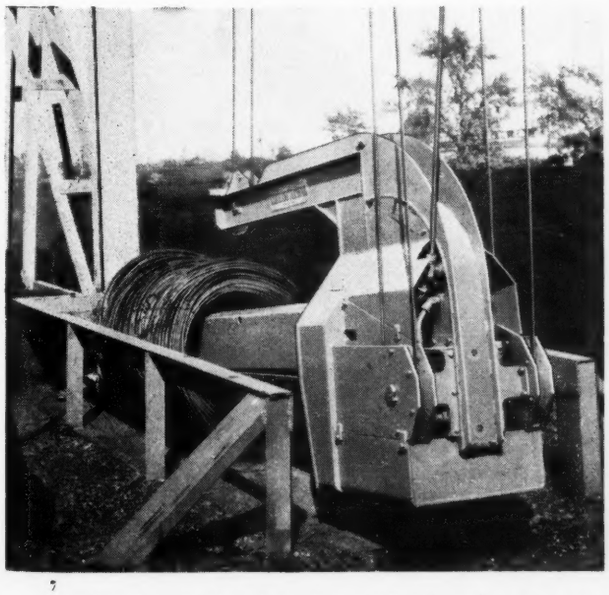
A vertical stacking hairpin type hook and carrier recently developed by the Cleveland Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, is said to increase the storage capacity of a warehouse for rod or wire coils by approximately 25 per cent. With this equipment, it is possible to maintain separation of rod and wire by sizes and alloys because it stacks the work in vertical piles. This is especially advantageous in stock-rooms where hundreds of different sizes of alloys must be kept on hand.

This vertical stacking unit will handle ten coils weighing 330 pounds each at one time, picking them up from a horizontal position and placing them in vertical piles supported by four posts. The unit will also lift off the coils from the vertical piles and place them in a horizontal position. The grab mechanism is actuated by a built-in hydraulic pump which causes a spreader plate to expand or contract. 90

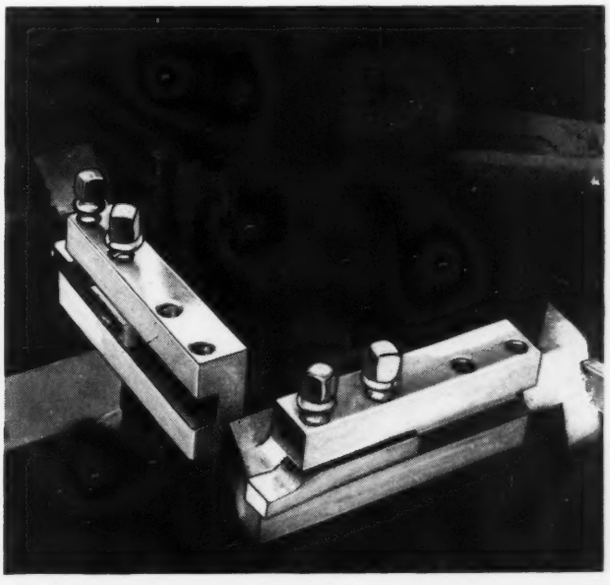
Rusnok Tool-Holder

The Rusnok Tool Works, 4840 W. North Ave., Chicago 39, Ill., announces a new tool-holder for use on turret lathes and lathes with square toolposts. The purpose of this tool-holder is to allow shops to standardize on one size tool and, at the same time, reduce set-up time, speed up production, enable multiple cutting to be done in one operation, and permit large cuts to be made with small tools.

The hardened steel holder is designed to accommodate 1/2-inch tools, which are held in place by two screws. After the tool-holder is set to the correct height by means of the toolpost rocker arm, the tool can be removed for grinding and replaced without disturbing the set-up. No adjustment is necessary, once the holder is set up in the toolpost. The new holder is available in two sizes, corresponding to regular 1-inch and 1 1/4-inch tools. 91



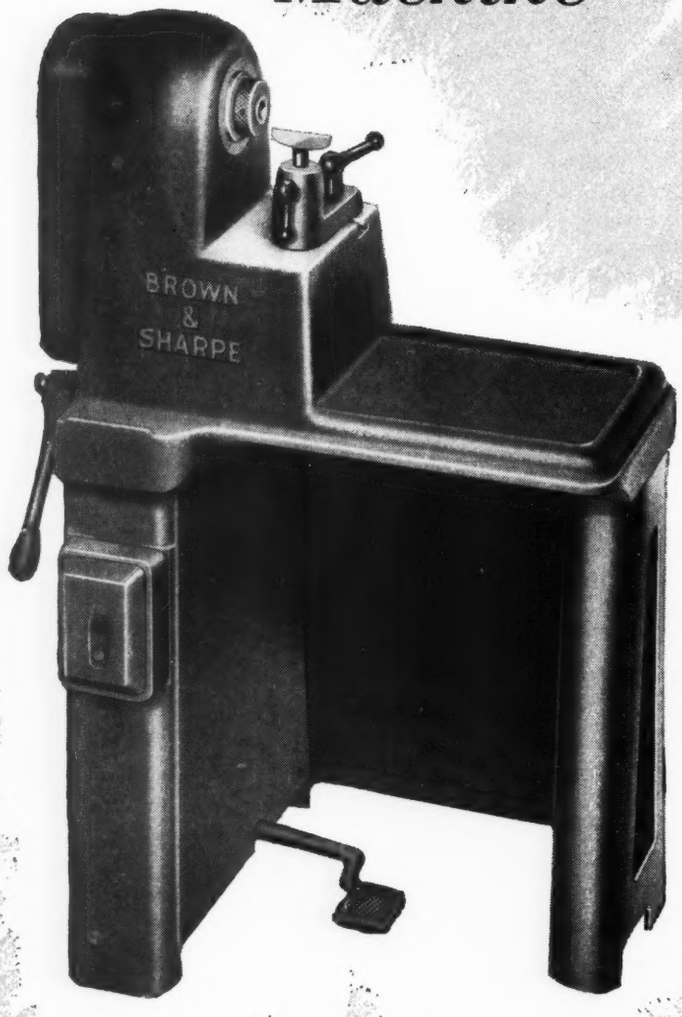
Cleveland vertical stacking hairpin hook and carrier designed for efficient handling of rod and wire coils



Tool-holder for use on turret lathes and lathes with square toolposts brought out by the Rusnok Tool Works

To obtain additional information on equipment described on this page, see lower part of page 226.

NEW Polishing and Finishing Machine



CAPACITY . . . spindle takes collets for up to 1" diameter stock. Swing over bed 9¾" diameter; over rest, 7¾" diameter.

BROWN &

Here's 3-way improvement for screw machine department

- ***Faster Burring***
- ***Faster Polishing***
- ***Faster Filing***

A NEW MACHINE FOR EFFICIENT POLISHING AND FINISHING OF SMALL PARTS

This new addition to the Brown & Sharpe line has three special features that make it extremely advantageous for general all-around polishing and finishing of small parts.

1. A compact, completely self-contained design that streamlines operations. It permits operator to work easily and comfortably when sitting or standing. Foot pedal control of collet and brake leaves operator's hands free to load, perform necessary operations and remove work.

2. Three spindle speeds... up to 4500 R.P.M. ... make it unusually flexible and versatile... suitable for a wide range of materials and operations.

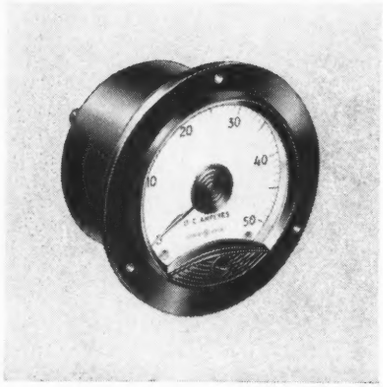
3. Only the spindle is started and stopped for inserting and removing work—reducing inertia, wear, and motor heating. Constant speed motor runs continuously with V-belt drive released by the foot pedal.

Here's an opportunity to round out the efficiency of your screw machine department with only a modest investment. Write for complete details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

QUICK FACTS ON CONVENIENT FEATURES

1. Spindle driven by 3 step V-belt cone pulley enclosed by guard. Spindle is mounted on ball bearings. **2.** Spindle nose is threaded for chuck or other workholding device. **3.** Readily adjusted tool rest for burring, hand shaving, etc. **4.** Convenient work tray provides ample space for work pieces. **5.** Knee space permits sitting comfortably at work. **6.** Convenient start-stop switch for driving motor. **7.** Spindle speeds quickly changed through V-belt and cone pulleys. **8.** Built to typical Brown & Sharpe quality standards that assure extra years of productive service.

SHARPE B·S

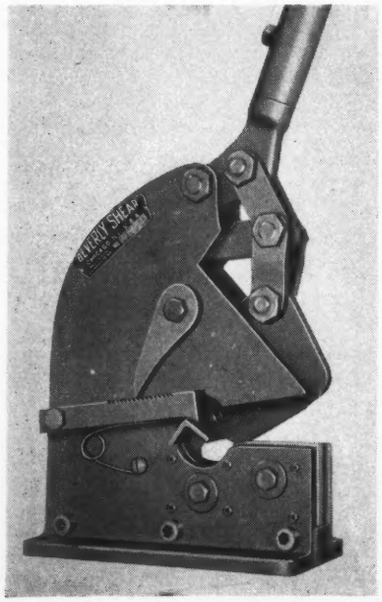


General Electric Long-Scale Panel Instrument

One of a new line of 3 1/2-inch, long-scale panel instruments of internal-pivot type construction, announced by General Electric Co., Schenectady 5, N. Y. This line includes direct-current, thermo-couple, and rectifier operated type instruments with standard 3 1/2-inch round and square cases having 250-degree scales 4.92 inches long. Intended for general industrial applications as well as for manufacturers of electronic devices, testing equipment, and similar apparatus. The instruments have permanent-magnet, moving-coil mechanisms, and are in the 2 per cent basic accuracy class. With the exception of high-sensitivity microammeters, they are available in all ratings now listed for conventional 3 1/2-inch instruments with 90-degree scales. 92

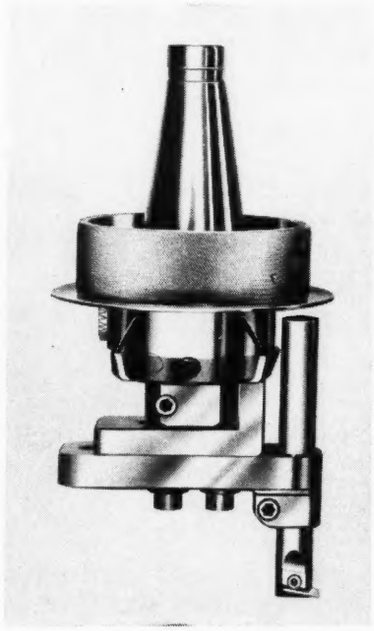
Beverly Cable-Cutter

Portable hand-operated cable-cutter recently introduced by Beverly Shear Mfg. Co., 3001 W. 111th St., Chicago, Ill. Employs a downward circular cutting principle, imparting a slicing rather than a pinching action that assures clean cutting of every strand of the steel cable at one stroke. Also adapted for cutting hollow core material, steel reinforced rubber hose, heavy electrical cable, and conduits. A snap action hold-down permits quick adjustments for size. Cutter blades are adjustable to compensate for wear and resharpening. 93



Everede Offset Boring Heads with Facing and Extension Attachments

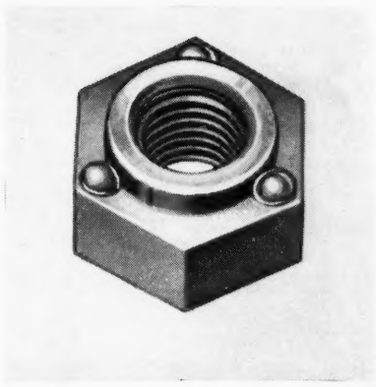
Offset boring head constructed for accurracy and simplicity of operation, now manufactured in three sizes for use in any type boring machine or turret lathe by the Everede Tool Co., Department



AM, 2000 N. Parkside Ave., Chicago 39, Ill. A direct-reading friction type dial assures quick accurate adjustment. The off-center lead-screw in the head makes it possible to adjust the length of the boring-bars for shallow or deep hole boring. The head has a normal boring capacity of 6 inches, and with the extension bracket shown, it is possible to bore a hole 12 inches in diameter or face an area of 113 square inches using a feed of either 0.0025 or 0.005 inch per revolution. 94

Self-Centering Gripco "Pilot" Projection Weld Nut

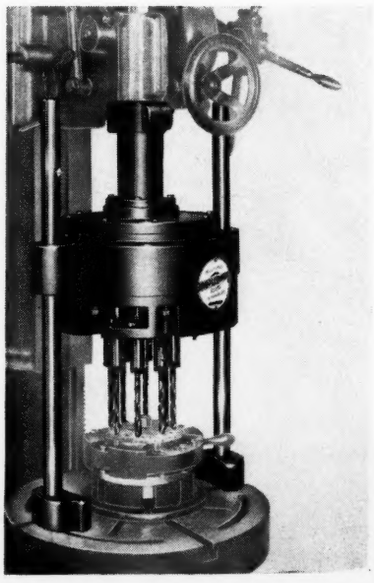
New type Gripco "pilot" projection weld nut designed for quick positioning or centering at the spot where it is to be welded to the metal. A circular collar with a diameter slightly less than that of the bolt hole automatically centers



the nut accurately for the welding operation. These nuts can be used advantageously where space is restricted or where metal sections are too thin to be threaded. The application process is the reverse of the usual procedure, the nuts being welded into their final positions, after which the bolts are screwed into the nuts. Furnished with common nut threads or with the Gripco "Double-Triangle" thread-locking feature, which securely locks the bolt to the nut. Manufactured by the Grip Nut Co., 310-Y S. Michigan, Chicago 4, Ill. 95

Multiple-Spindle Drill Head

"Adjustafix" multiple-spindle drill head designed to reduce multiple drilling costs by eliminating expensive set-ups. The spindles can be quickly located in the head for any drilling or other operation by means of a drill pattern plate. Any number of drill pattern plates can be made up with hole lay-outs or spacings to suit different jobs or to conform with new lay-outs for changes in the design of a part. Thus the drill head can be changed quickly from one job to another by simply interchanging drill pattern plates which require little stor-

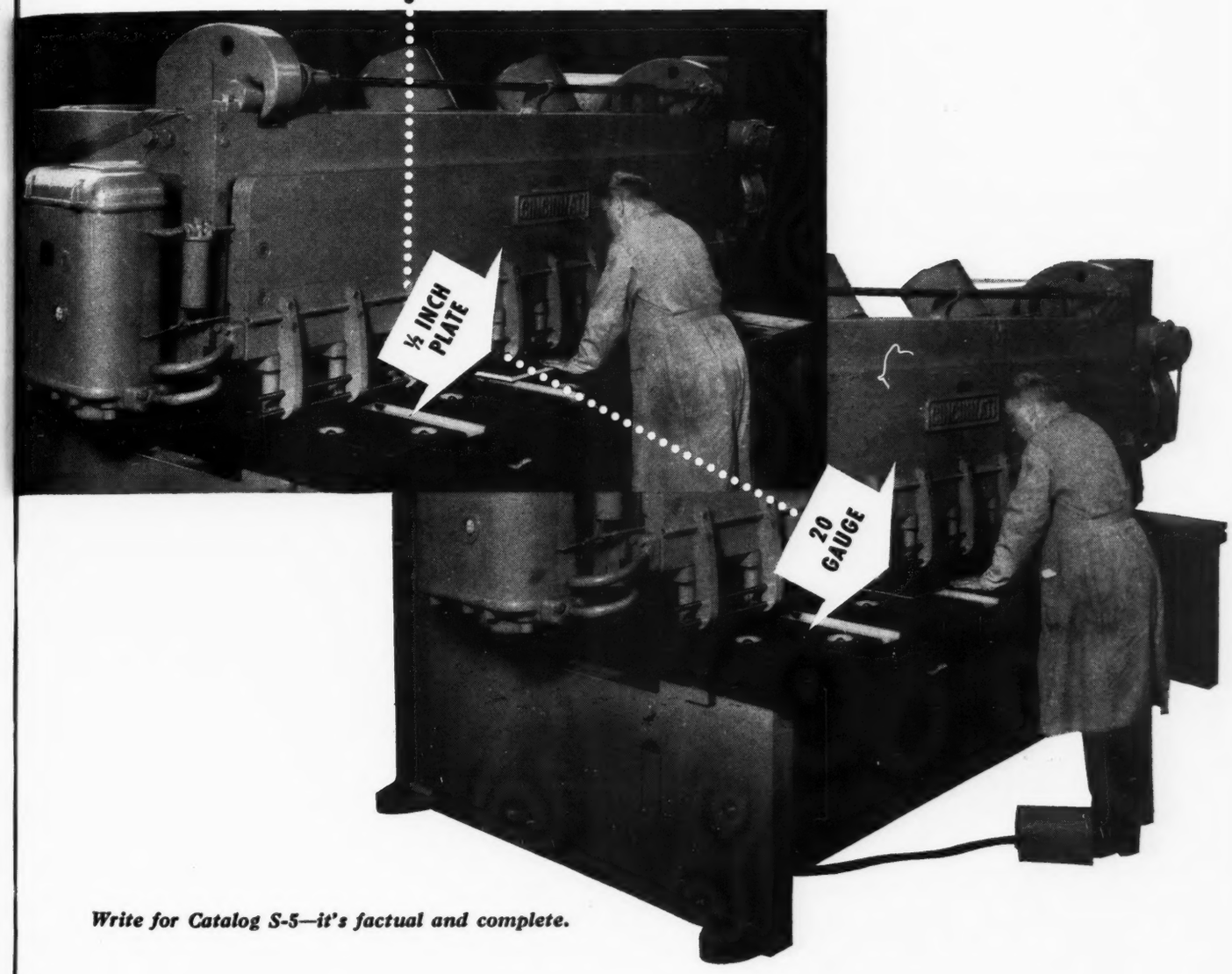


To obtain additional information on equipment described on this page, see lower part of page 226.

SHEAR ½" PLATE OR 20 GAUGE SHEETS

without changing knife clearance

ON A CINCINNATI . . .



Write for Catalog S-5—it's factual and complete.

. . . You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage—saves time. Remember, changing knife clearance interrupts production. Investigate the Cincinnati All-Steel Shear and its accurate, time-saving features.

THE CINCINNATI SHAPER CO.

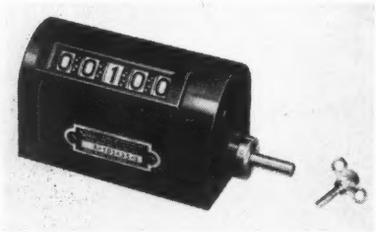
CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

age space and are always ready for use on duplicate work. Can be used for tapping, reaming, spot-facing, boring, counterboring, and milling operations, as well as for drilling. Fully automatic lubrication is provided when the heads are used in either a horizontal or a vertical position. Brought out by the United States Drill Head Co., 616 Burns St., Cincinnati 4, Ohio. 96

Veeder-Root Counting Device

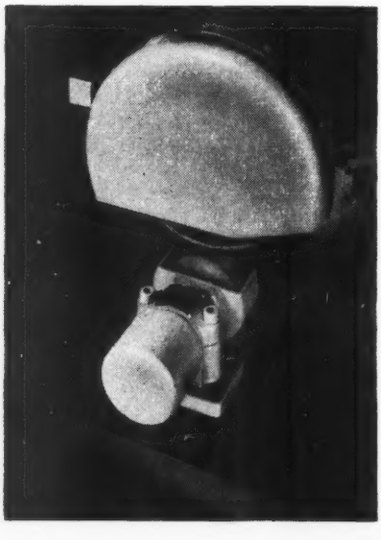
New "Duo-Cam" counter developed by Veeder-Root, Inc., Hartford 2, Conn., for such uses as counting the number of pieces or parts in size-grading oper-

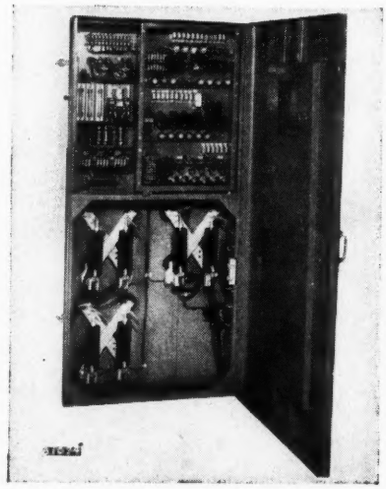


ations. Can be supplied both as a revolution ratchet counter, adding one count for each revolution of the driveshaft in either direction, and as a ratchet with stops counting arrangement that can be made to order for adding one count for each oscillation of the actuating lever through an angle of 30 degrees. Maximum recommended speed of the revolution type counter is 200 counts per minute, and of the ratchet with stops type, 500 counts per minute. Can be reset quickly by clock type key. 97

Norton Truing Device for Diamond Abrasive Wheels

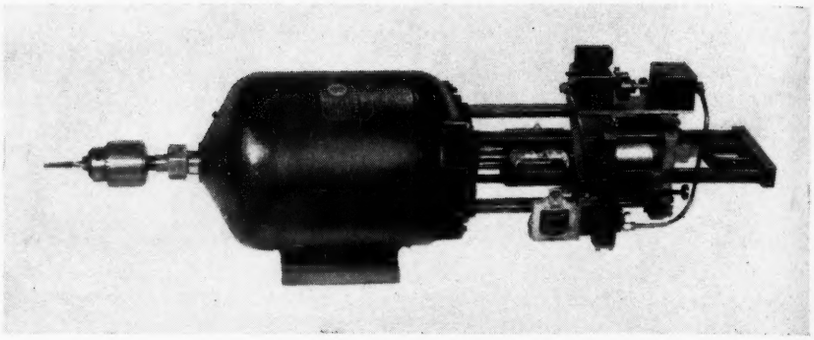
New tool for truing diamond abrasive wheels, known as the "brake-controlled truing device," just announced by the Norton Co., Worcester 6, Mass. This compact, self-contained device is simple to set up and operate. It is driven by the diamond wheel to be trued, rather than by a separate motor. The device is designed for truing diamond wheels of all bond types, with the exception of resinoid-bonded wheels finer than 220 grit. The latter type wheels can be easily trued with a square or rectangular-shaped Crystolon vitrified-bond abrasive stick held in a vise and passed across the wheel face. 98





Westinghouse Three-Phase Low-Frequency Resistance Welding Control

New three-phase, low-frequency welding control designed to so operate a welding transformer as to draw power from a three-phase line and convert it to a lower frequency, single-phase current and supply this to the electrodes of a resistance welder. High power characteristics inherent with low-frequency current result in reduced KVA demand. Total power demand is spread over all phases of any standard three-phase, 60-cycle, 220-, 440-, or 550-volt primary power source. Weld quality is said to be improved because the wave shape obtained allows a smooth flow of heat into the metal. Control can be mounted on the floor or on the side of the machine. Product of the Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. 99

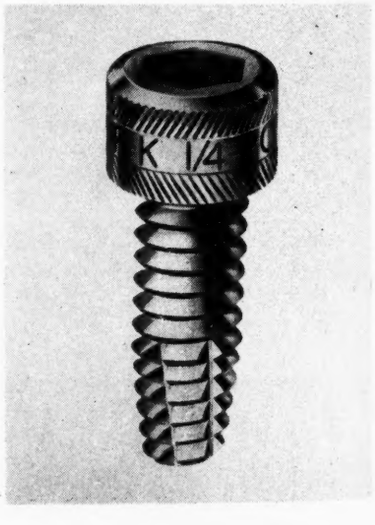


Black Air-Operated Tapping Unit

New air-operated tapping unit brought out by the Black Drill Co., Division of Black Industries, 1400 E. 222nd St., Cleveland 17, Ohio. The unit is operated by a double-acting air cylinder controlled by a four-way air valve. Adjustable needle valves control the flow of air so that the tap follows its own lead without chamfering the first threads and does not strip the thread on the return stroke. Reversal is obtained through a secondary air cylinder. Depth control is held within 0.001 inch. This unit can be used either singly or in gangs. 100

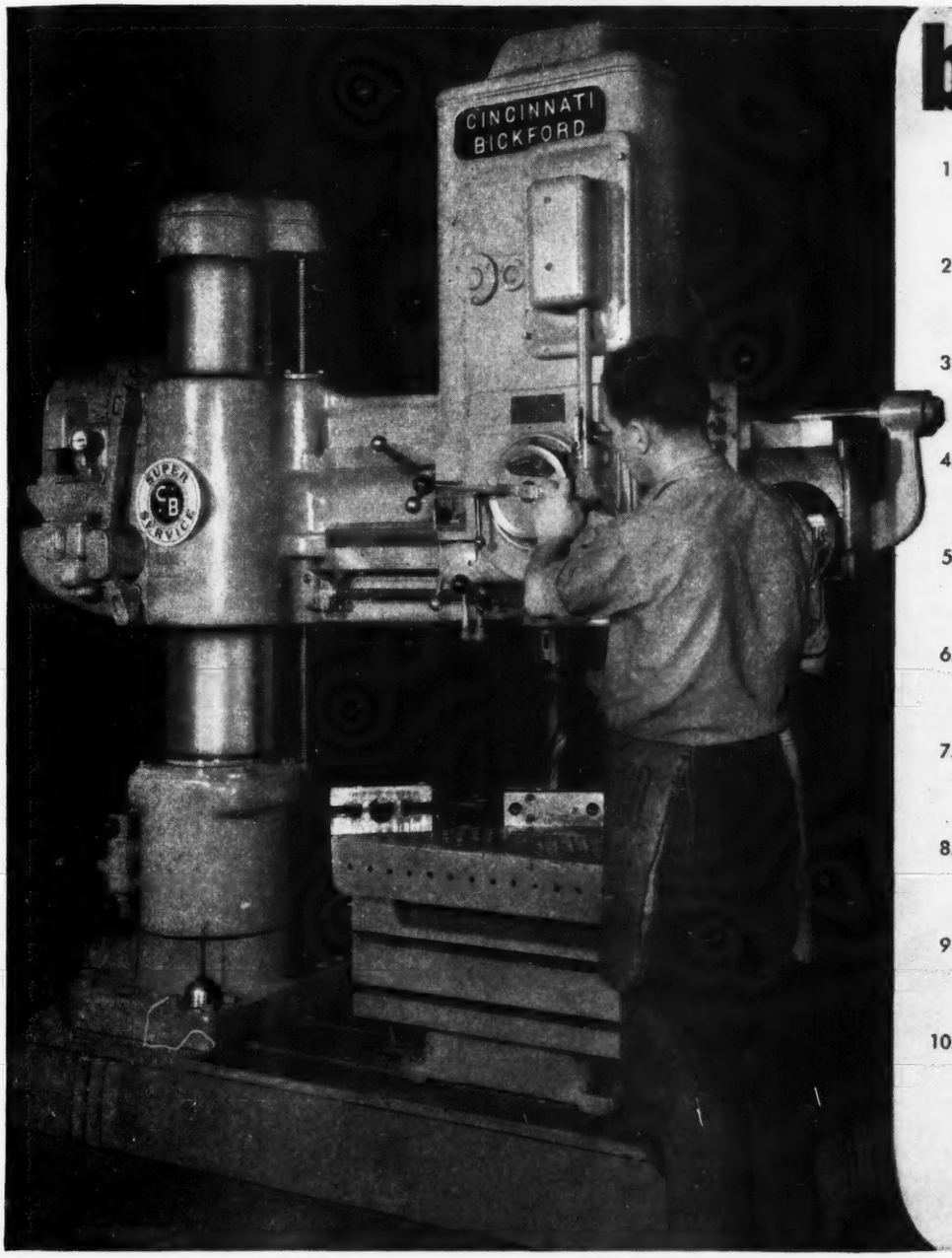
Parker-Kalon Self-Tapping Socket-Head Cap-Screw for Metals or Plastics

Self-tapping socket-head cap-screw brought out by the Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y. Consists essentially of a combination of the "Size-Marked" socket head of the manufacturer's standard cap-screw and the threaded body of its regular Type F self-tapping screw, which cuts a thread in a plain drilled hole in metals or plastics as the screw is turned. Thus the new screw eliminates regular tapping operations and serves to speed up assembly work on a wide variety of products. 101



To obtain additional information on equipment described on this page, see lower part of page 226.

2 to 3 times FASTER production



because

1. Controls are all centralized at the head —
2. All 36 speeds and 18 feeds are in the head —
3. Instant spotting with power rapid traverse —
4. Quick acting hydraulic arm and column clamp —
5. Fast elevating and lowering of arm —
6. Large, clear compensating depth gauge —
7. Positive feed clutch controlled with finger tip ease —
8. Drive from motor to spindle is anti friction mounted —
9. Automatic filtered oiling driven by constant speed pump —
10. Selective sliding gears are used throughout —

Job — The Cincinnati Bickford Super Service Radial with 4' arm length 11" diameter column is at the Richmond Manufacturing Company, Lockport, N. Y. — drilling and reaming 2-¼" holes 3" deep. They say, "This machine is very rapid and easy to handle and is two to three times faster than the machine previously used on this job."

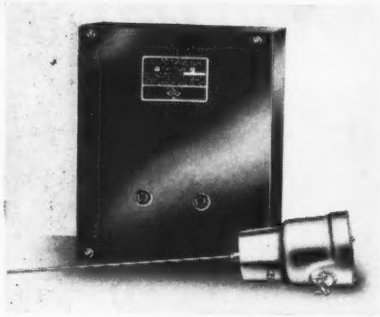
Equal Efficiency of Every Unit Makes the Balanced Machine

Good judgment in selecting the proper machines, tools, and fixtures will consistently produce the best manufacturing results. Our CUSTOMER PRODUCTION ENGINEERING SERVICE in the metal drilling field represents the collective experience of many years (since 1874). Make your problems ours - - let us show you a profitable Radial or Upright Drill production application. Your most urgent production problems warrant our immediate attention.

THE CINCINNATI BICKFORD TOOL CO. RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28"
Jig Borers, Portable Horizontals,
Spacing Table Machines

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

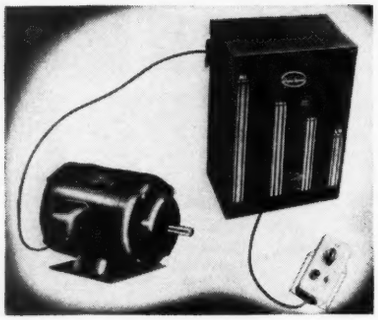


Bristol Combustion Safeguard for Furnaces

Instrument designed to protect gas-fired furnaces and ovens, boilers, driers, and similar heating equipment from danger of gas explosions during ignition and operation and when the gas is shut off. This "Electronic Pyrotrol" performs all the operations of lighting a gas appliance that are recommended for absolute safety. If the normal operation fails at any step, the lighting up cycle stops and closes any valve that has been opened. In case the power supply should fail, the entire system is shut down. The safeguard shuts off all gas, then lights a signal, sounds an alarm, and makes relighting impossible if any tube or relay in the "Pyrotrol" fails to function in its normal manner. Made in six models by the Bristol Co., Waterbury 91, Conn. 102

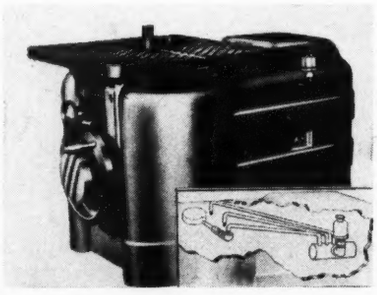
Protractor Type Welding Clamps

Clamps developed primarily to hold plates, bars, tubing, and other metal parts while being welded, brazed, or soldered. By the use of these clamping devices, known as "Pro-Clamps," piping systems can be completely installed and assembled before the first weld is applied, thus making it unnecessary to provide special fixtures and templets. The clamps are so mounted that they can be rotated and preset to hold pieces at any angle from 0 to 180 degrees by using two accurate protractor scales inscribed on the clamps. Pieces from 0 to 1 inch thick can be held in place for welding as shown in the illustration. Size of clamps is 5 1/2 by 8 inches, and weight 3 pounds. Made by the Bernard Welding Equipment Co., 741-43 E. 71st St., Chicago 19, Ill. 103



"Dyna-Speed" Electronic Motor Control

"Dyna-Speed" electronic motor control unit that allows remote stepless speed adjustment and control of fractional-horsepower motors. Consists of a rectifier cabinet, a specially designed direct-current ball-bearing motor, remote-control dial box and 10 feet of connecting cable. By setting the speed control dial knob, any speed within a range of 80 to 1800 R.P.M., for example, can be maintained regardless of changes in load. Constant torque is maintained over the entire speed range. Particularly suited for use in the operation of lathes, printing presses, conveyors, textile machines and similar equipment. Available in ratings of 1/4 and 1/2 H.P. Placed on the market by the Brown-Brockmeyer Co., Dayton 1, Ohio. 104

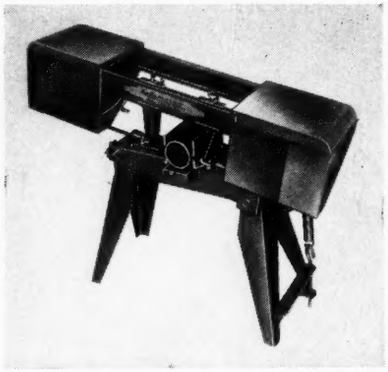


Boyar-Schultz Profile Grinder with New Lubricating System

Profile grinder manufactured by the Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill., equipped with new oiling system. This system (see insert) consists of a reservoir with three distributing lines, one to the spindle and one each to the two ways on which the oscillating mechanism operates. Thus the spindle is kept thoroughly lubricated, thereby increasing its useful life. 105

Metal-Cutting Band Saw with Constant Pressure Control

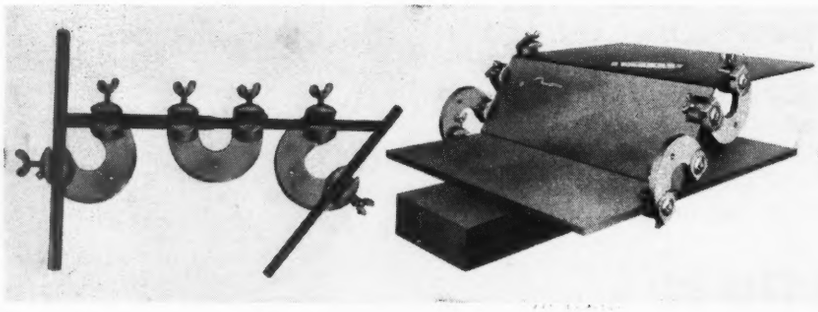
Portable, low-cost metal-cutting band saw announced by Machine Tool Division, Kalamazoo Tank & Silo Co., 500-508 Harrison St., Kalamazoo, Mich. Will cut angles, bars, tubes, and

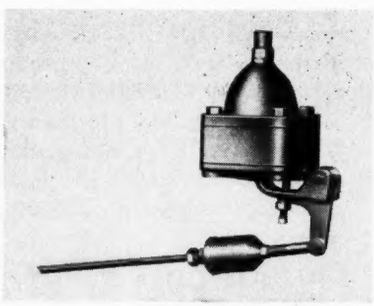


pipe in sizes up to 6 by 10 inches. Features include four cutting speeds, ranging from 53 to 266 feet per minute; hydraulic dashpot mechanism designed to insure controlled, constant pressure of cut; and provision for mounting blade from top, requiring only a half minute for changing blades. The stand has provision for mounting standard 60-cycle, 110-volt, 1/3-H.P. motor. The band saw with motor weighs only 198 pounds. 106

Ingersoll-Rand "Drill-More" Floating-Speed Regulators

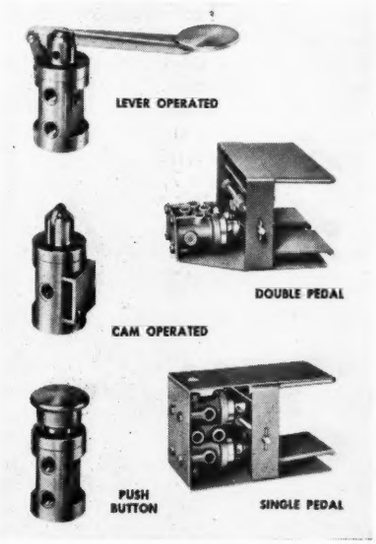
Improved regulator for the "Drill-More" capacity control of portable compressors, announced by the Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. This UL-83 "Floating Speed" regulator is said to be much simpler in operation and easier to adjust than preceding models. With it, speed steps and cycl-





To obtain additional information on equipment described on this page, see lower part of page 226.

ing are eliminated, the average air pressures maintained are from 15 to 20 pounds per square inch higher, and fuel savings ranging up to 40 per cent are obtained. When less than the full capacity of the compressor is being used, the regulator slows down the speed to the lowest practical working point, and when the air demand changes, the compressing speed is automatically increased. 107



Hanna Pilot Valves

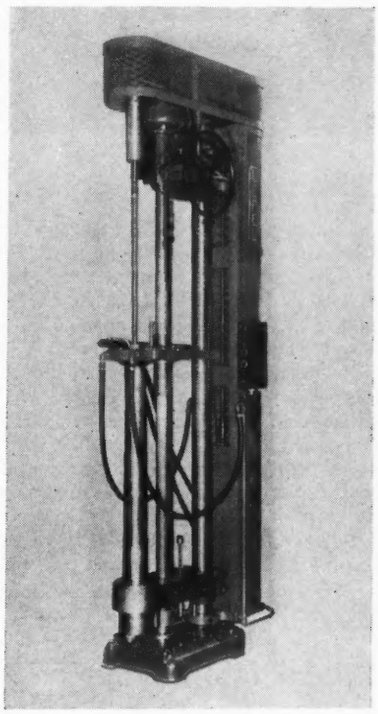
A series of small pilot valves developed by Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill., for efficient, direct control of small cylinders or automatic control of large cylinders. Available in cam-, lever-, push-button-, or foot-operated types. All are three-way valves except the foot-operated four-way units. 108

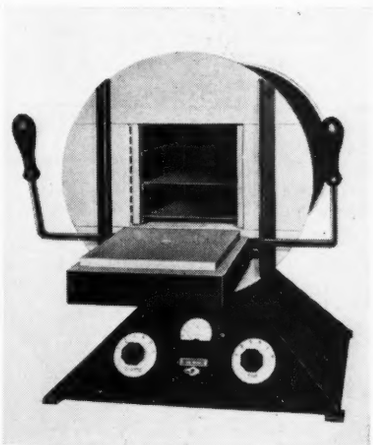
Air-Draw Muffle Furnace

Air-draw muffle furnace for heating operations requiring temperatures up to 1250 degrees F. Although designed primarily for tempering or drawing tool and die steels, this furnace provides a means for rapid and uniform heating of metals and other materials. A centrifugal fan and heat-resistant alloy baffle insure positive high-speed circulation of air throughout the furnace chamber. Adjustable shelves serve to locate the work at different levels. Built by the Hevi Duty Electric Co., Milwaukee 1, Wis. 109

Lepel Progressive-Feed Surface Hardening Machine

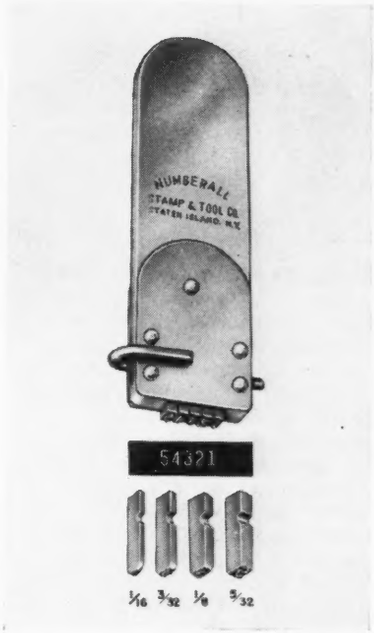
New progressive-feed machine designed for faster surface hardening of shafts, bars, lead-screws and fabricated parts up to 5 feet long and 3 inches outside diameter. This machine, known as the P60 progressive-feed unit, can be used for either continuous hardening of long rods or shafts throughout their entire lengths or for hardening selected areas. The depth of hardness is controlled by regulating speed of travel of work coil. The unit can also be used for progressive soldering or brazing of seams and joints. Introduced by Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York 23, N. Y. 110





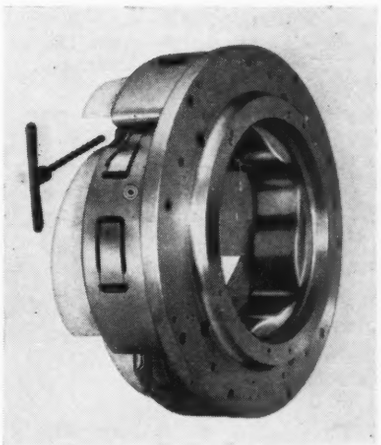
Numberall Steel Type Holder for Light-Duty Marking

New steel type holder brought out by the Numberall Stamp & Tool Co., Huguenot Park, Staten Island 12, N. Y., for use in marking or stamping brass, aluminum, cold-rolled steel, and similar metals. All sizes of characters up to 5/32 inch high can be used in this holder. The holder is made of alloy steel and tempered to prevent mushrooming. Type can be changed rapidly and cannot be inserted incorrectly. One stroke of hammer serves to stamp work with accurately spaced numbers. 111

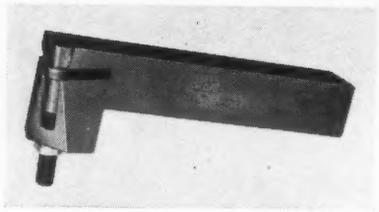


New Segmental Grinding Chuck

New type segmental grinding chuck developed by Abrasive Associates, 1216 Industrial Trust Bldg., Providence 3, R. I., and available from the manufacturer, Abrasive Machine Tool Co., East Providence 14, R. I. Chuck is standardized so that two sizes of abrasive segments serve to cover all grinding wheel requirements for vertical- and horizontal-spindle face grinders. The sharp-pointed segments are placed in circular echelon overlap formation, and cut with a rapid sweeping action, which throws out chips and dirt. 112



To obtain additional information on equipment described on this page, see lower part of page 226.

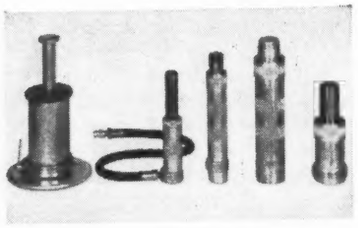


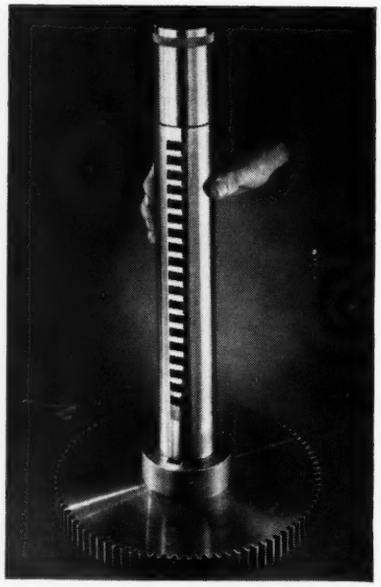
"Redy Rigid" Tool-Holder

Tool-holder with a new locking method designed to eliminate bit vibration and reduce tool breakage. Developed by the American Die & Tool Co., Reading, Pa. This tool-holder, known as the "Redy Rigid," clamps the carbide bit against the holder with maximum rigidity by means of a lock-block screw and lock-nut arrangement that cannot work loose even on automatic machines operated at speeds and feeds which develop severe vibration. The tool-holder is available for round, square, rectangular, and triangular bits of all standard sizes. Tools can also be made to suit special requirements. 113

Manually Operated Power Ram

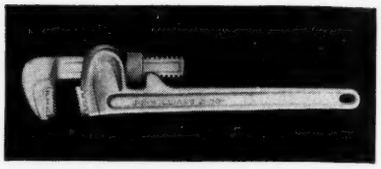
Power rams with hydraulic pump that can be operated by hand or foot pressure, permitting both hands to be used for setting up and handling work. These power rams, known as "Step-Draulic," are adapted for a variety of uses in metal-working shops, such as disassembling dies, die repair work, and clamping or operating fixtures. Supplied in lengths from 1 1/2 inches when collapsed to 15 7/16 inches when extended. They range in capacity from 2 to 12 tons, and are designed for working pressures in excess of 10,000 pounds per square inch. Made by J. O. Stephenson Foundry & Mfg. Co., 548 E. Fort St., Detroit 26, Mich. 114





Glenny "Jumbo" Broach

Glenny "Jumbo" broach available in six sizes ranging from 1 9/16 to 2 1/2 inches in diameter from the Kase Machine Co., 18429 Buffalo Ave., Cleveland 19, Ohio. Interchangeable cutting blades of any width up to 5/8 inch can be furnished. The broach shown is used to cut 5/8-inch wide keyways in large gears on a production basis. Features include fully protected cutting blades, elimination of chatter, accurate centering in minimum time, infinitely variable adjustment for cutting depth, and generally simplified operation. 115

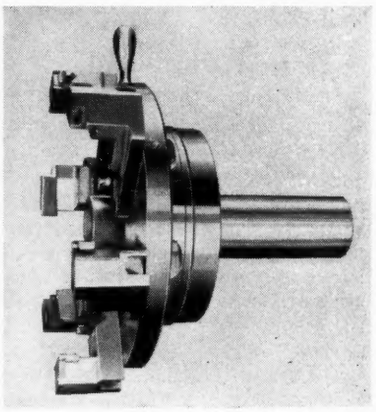


Williams Light-Weight Aluminum Pipe Wrench

Light-weight pipe wrench drop-forged from a special aluminum alloy of high tensile strength, heat-treated to obtain maximum strength and toughness. The replaceable alloy-steel jaw inserts are easily interchangeable. Multiple dovetail design and retaining screw assure easier assembly and firm anchorage. Product of J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y. 116

Landmatic Die-Head for Threading Valve-Seat Rings — Correction

The new Landmatic die-head developed by the Landis Machine Co., Waynesboro, Pa., which was described in September MACHINERY, on page 224, was shown in an inverted position. It is illustrated here in the correct position.



To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in October, 1949, MACHINERY.

No.	No.	No.	No .	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....**POSITION OR TITLE**.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....**STATE**.....

Keep Hydraulic Pumps Clean

LIKE THIS

Note cleanliness of this part taken from a hydraulic pump. System charged with Texaco Regal Oil (R & O).

Ordinary oil was used in the hydraulic system from which this pump part was removed. Damage from rust and sludge resulted.

Photos Courtesy of American Engineering Co.

USE Texaco Regal Oils (R&O)

Make pumps and other parts of hydraulic systems last longer and work more smoothly by charging the systems with *Texaco Regal Oils (R & O)*. These world-famous, turbine-grade oils keep your hydraulic mechanisms operating at top speed and efficiency.

Texaco Regal Oils (R & O) are fully resistant to rust and oxidation, and are specially processed to prevent foaming. They keep hydraulic systems clean . . . protect pumps and valves against wear and fouling . . . assure smooth, responsive hydraulic action for longer periods of time.

There are suitable viscosities of *Texaco Regal Oils (R & O)* for every size and type of hydraulic mechanism. No "cutting back" is required. These quality oils are recommended by leading builders of hydraulic equipment, and many ship their units charged with them.

Let a Texaco Lubrication Engineer help you improve the efficiency of all your plant machinery. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 232 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the October, 1949, Number of MACHINERY

High-Speed Heating of Metals

SELAS CORPORATION OF AMERICA, Erie Ave. and D St., Philadelphia 34, Pa. 78-page publication containing a technical description of the heating of metals at high rates of speed by the "Gradiation Process," in which use is made of gas-heated automatically controlled furnaces with high heat gradients. Production executives can obtain copies by writing directly to the company.

Special Tooling Equipment

BUNELL MACHINE & TOOL CO., 1601 E. 23rd St., Cleveland 14, Ohio. Catalogue showing the facilities of the company for building special machines, tooling, and dies. Copies can be obtained if requested on a company letterhead addressed directly to the Bunell Machine & Tool Co.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady 5, N.Y. Bulletin GEA-1522-F, introducing the company's new line of manually operated starters for alternating-current motors up to 7 1/2 H.P., designed for use on farm machinery, textile looms, small pumps, blowers, and grinders. Bulletin GEA-4469A, descriptive of G-E unit-cooled direct-current motors for dusty, dirty, or oil-laden atmospheres. 1

Production Bending Machines

PEDRICK TOOL & MACHINE CO., INC., 3638-42 N. Lawrence St., Philadelphia 40, Pa. Bulletin containing technical information on the tube-bending process, as well as suggestions for selecting the proper machine and instructions for operating. The various models of Pedrick production bending machines are illustrated and described and tables of capacities are included. 2

Spring Testing Equipment

HUNTER SPRING CO., Lansdale, Pa. Circular announcing three products of the Apparatus Division of the company, recently organized to design and build precision spring testing equipment. The products shown include a force indicator, a wire fatigue tester, and the Baldwin-Hunter spring tester for both compression and extension springs. 3

Special Machinery and Tools

ZAGAR TOOL, INC., 23880 Lakeland Blvd., Cleveland, Ohio. Engineering Manual No. 10, containing dimensional drawings for all models of collet fixtures, broaching machines, and multiple-spindle gearless drill heads built by the company. Included are illustrations showing applications of the various tools. 4

High-Speed Hydraulic Presses

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio. Booklet entitled "Case Histories in the Reduction of Metal-Working Costs," containing seventeen different case studies of a variety of production problems in metal-working plants and their solution by the use of H.P.M. hydraulic presses. 5

Steel Products

LUKENS STEEL CO., 503 Lukens Bldg., Coatesville, Pa. Booklet entitled "Lukenomics? . . so what?," describing the company's complete line of products, including steel plates, clad steels, heads, plate shapes, welded components, and machines, as well as the facilities and services available. 6

Bakelite Resins for Sand Cores

BAKELITE CORPORATION, UNIT OF UNION CARBIDE & CARBON CORPORATION, 30 E. 42nd St., New York 17, N. Y. Technical data file, describing the properties, applications, and advantages of sand-core resin binders for ferrous and non-ferrous castings. 7

Pneumatic Die Cushions

DAYTON ROGERS MFG. CO., 2824 Thirteenth Ave., S., Minneapolis 7, Minn. Circular illustrating and describing the improved Dayton Rogers universal pneumatic die cushion and the various models in which it is made to suit different requirements. 8

How to Select Alloy Steel

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. 24-page booklet entitled "How to Specify and Buy Alloy Steel with Confidence," containing information of interest to those concerned with selecting, buying, or heat-treating alloy steel. 9

Pressure Gages

W. C. DILLON & CO., INC., 5410 W. Harrison St., Chicago 44, Ill. Bulletin containing dimensions, engineering data, prices, and typical applications covering the new Dillon mechanical pressure gage, designed to operate in limited space. 10

Die Springs

PARAGON SPRING CO., 4615 W. Fulton St., Chicago 44, Ill. Bulletin describing a new assortment of 27 die springs recently brought out by the company to meet the requirements of general shop applications and experimental departments. 11

Flexible-Shaft Machines

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 521, entitled "Kellerflex Makes Craftsmen," illustrating and describing the Pratt & Whitney new Series M multiple-speed, flexible-shaft machines. 12

Rust Preventives

ESSO STANDARD OIL CO., 15 W. 51st St., New York 19, N. Y. Publication entitled "Rust-Ban," containing detailed recommendations for the selection of rust preventives, as well as information on the use of "Rust-Ban" protective coatings. 13

Heavy-Duty Power Feed

BELLOWS CO., 222 W. Market St., Akron. Ohio. Leaflet illustrating and describing the Bellows Model BGF-5 heavy-duty controlled-air power feed, designed to replace manual feeding in drilling, milling, and grinding operations. 14

Blast-Cleaning Equipment

AMERICAN WHEELABRATOR & EQUIPMENT CORPORATION, 555 S. Byrkit St., Mishawaka, Ind. Bulletin 134-A, illustrating and describing the redesigned Wheelabrator Tumblast—an airless centrifugal type blast-cleaning machine. 15

Precision Boring and Milling Machines

DEVLIEG MACHINE CO., 450 Fair Ave., Ferndale 20 (Detroit), Mich. Bulletin illustrating and describing the design features of the Models 3-B and 4-B "Jigmils." Complete specifications are included. 16

Engineering Research

NEW YORK UNIVERSITY COLLEGE OF ENGINEERING, RESEARCH DIVISION, University Heights, New York 53, N. Y. Catalogue describing the engineering research facilities of the university, available to industrial companies and engineering and research organizations. 17

Gage Testers

STAR BRASS MFG. CO. DIVISION, WILLIAMS & HUSSEY MACHINE CO., INC., Wilton, N. H. Circular describing the construction of the Star combination dead-weight gage tester and giving operating instructions. 18

Sight Conservation

AMERICAN OPTICAL CO., Southbridge, Mass. Bulletin entitled "Improved Industrial Vision—A Bonus for Management, a Benefit for Employes," describing sight conservation programs in industry and the results obtained. 19

Abrasive-Resistant Alloy

AMERICAN BRAKE SHOE CO., ELECTRO-ALLOYS DIVISION, Elyria, Ohio. Bulletin describing the physical properties, advantages, and applications of an abrasive-resistant material known as "Thermalloy HC-250." 20

Air-Operated Controllers

BRISTOL CO., Waterbury, Conn. Bulletin A120, giving information on the company's new line of Series 500 air-operated controllers for automatically controlling temperature, pressure, flow, liquid level, humidity, etc. 21

Diamond Abrasives

ELGIN NATIONAL WATCH CO., INDUSTRIAL PRODUCTS DIVISION, Aurora, Ill. Bulletin describing Elgin "Dymo" diamond compound, including a chart showing the new grading and color identification systems and price lists. 22

Flexible Metal Hose

ATLANTIC METAL HOSE CO., INC., 123 W. 64th St., New York 23, N. Y. Catalogue 100, describing new uses for existing types of flexible metal hose and new types of hose developed to meet a variety of problems. 23

Belt Conveyors

LIPPMANN ENGINEERING WORKS, 4603 W. Mitchell St., Milwaukee 14, Wis. Bulletin 1400, containing 32 pages on stationary, portable, and special-purpose belt conveyors. 24

Hobbing Machines

BARBER-COLMAN CO., Rockford, Ill. Catalogue describing the hobbing process and its application, as well as the Barber-Colman line of hobbing and hob-sharpening machines and hobs, milling cutters, and reamers. 25

Inclinable Presses

E. W. BLISS CO., Toledo 7, Ohio. Catalogue 2-C, describing the production advantages of Bliss open-back inclinable presses and improvements in this line, which includes models ranging from 10 to 200 tons capacity. 26

Bearing Balls

PIONEER STEEL BALL, INC., 37 Mill St., Unionville, Conn. Products Data Sheet, giving statistical tables and technical data on Pioneer steel bearing balls, bronze balls, stainless-steel balls, burnishing balls, etc. 27

Industrial Lubricants

ACHESON COLLOIDS CORPORATION, Department M, Port Huron, Mich. Bulletin 424, describing the application of "dag" colloidal graphite for industrial lubrication in the temperature range above 400 degrees F. 28

Gear Checkers

EASTMAN KODAK CO., INDUSTRIAL OPTICAL DIVISION, 343 State St., Rochester 4, N. Y. Booklet describing the Kodak Conju-Gage line of gear checking instruments, applicable to both spur and helical gears. 29

Corrosion-Resistant Castings

COOPER ALLOY FOUNDRY CO., Hillside 5, N. J. Bulletin containing a chart showing the relative corrosion resistance of stainless steel, Monel, and nickel castings to different types of corrosive agents. 30

Sprayweld Equipment

WALL COLMONOY CORPORATION, 19345 John R St., Detroit 3, Mich. Booklet describing the Colmonoy sprayweld process and spraywelding gun adapted for welding, metallizing, and hard-facing applications. 31

Pull-Down Broaching Machine

LAPOINTE MACHINE TOOL CO., Hudson, Mass. Pamphlet descriptive of the Lapointe vertical, variable-speed hydraulic pull-down broaching machine with 5 to 50 tons capacity and 36- to 60-inch stroke. 32

Heat-Treating of Stainless Steels

ARMCO STEEL CORPORATION, Middletown, Ohio. 36-page booklet giving recommended procedures for heat-treating and pickling Armco stainless steels. 33

Variable-Speed Control

REEVES PULLEY CO., Columbus, Ind. Bulletin VN-4912, illustrating and describing the new Reeves "Vari-Speed Jr.," a simplified variable-speed control for light horsepower requirements. 34

Hydraulic Grinders

RIVETT LATHE & GRINDER, INC., Brighton 35, Boston, Mass. Bulletin 1024A, describing the construction features and applications of the new Rivett 1024 universal hydraulic grinder. 35

Polishing Machines

BUEHLER LTD., 165 W. Wacker Drive, Chicago 1, Ill. Bulletin illustrating and describing AB polishing machines for the metallurgical laboratory. 36

Hydraulic Oil Handbook

E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa. Revised edition of "Houghton Handbook on Hydraulic Oils," including new information on the flushing of hydraulic systems. 37

Abrasive Wheels

BAY STATE ABRASIVE PRODUCTS CO., 12 Union St., Westboro, Mass. Folder describing Bayflex abrasive wheels for bench grinders, cut-off machines, table saws, and power sanders and grinders. 38

Flexible-Shaft Couplings and Casings

DIAMOND CHAIN CO., INC., Indianapolis 7, Ind. Bulletin 19, containing information on Diamond flexible-shaft couplings and the newly developed light-weight revolving coupling casing. 39

Die-Less Duplicating

O'NEIL-IRWIN MFG. CO., 332 Eighth Ave., Lake City, Minn. Catalogue containing 40 pages of information on the Die-Acro system of die-less duplicating, including recent equipment. 40

Fixture Clamps

MORTON MACHINE WORKS, 2421 Wolcott St., Ferndale 20, Mich. 72-page engineering catalogue covering the company's complete line of jack locks, fixture clamps, and standard details. 41

Shims, Lock-Nuts, and Stampings

LAMINATED SHIM CO., INC., Glenbrook, Conn. Circular including specifications, design factors, and applications of the company's line of laminated shims, lock-nuts, and stampings. 42

Extreme-Pressure Lubricant

ALPHA CORPORATION, Greenwich, Conn. Bulletin 52, describing the properties and applications of "Molykote," a dry lubricant developed for extreme-pressure use. 43

Aluminum Extruded Shapes

REYNOLDS METALS CO., 2500 S. 3rd St., Louisville 1, Ky. Bulletin describing the various applications and design possibilities of aluminum extruded shapes. 44

Die Sets and Accessories

STANDARD DIE SET MANUFACTURERS, INC., Providence 7, R. I. Catalogue containing specifications on the company's standard line of die sets and accessories. 45

Precision Chromium Plating

CRO-PLATE CO., INC., 3343 Main St., Hartford 5, Conn. Circular entitled "Chromium Plating as an Essential Tool of Industry." 46

Carbide Drills

ACE DRILL CORPORATION, Detroit 26, Mich. Catalogue 106, listing sizes and prices of Ace cemented-carbide drills. 47

Contour Polishing

BEHR-MANNING, Troy, N. Y. Circular entitled "Polish Toughest Contours with New Belt Methods." 48

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (October, 1949) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME..... POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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By E.S.S.

BETWEEN GRINDS

Read and Advance!

One of the biggest industries in the country is trying hard to outweigh high labor costs by higher productivity. You can see for yourself how it is being accomplished by reading November MACHINERY — our Automotive Production Number. And by going a step further, you can apply the methods described toward improving your own 1950 operations.

How to Get an Order South of the Border

The Mexican sales engineer can now apply the good advice which Bernard Lester delivers monthly to our readers in his column "The Sales Engineer and His Problems." MACHINERY has granted permission to the manager of Equipos Industriales S.A. to republish these articles in Spanish in the magazine of the Mexican Society of Mechanical and Electrical Engineers. We are wondering how Senor Lester's vernacular will fare—for instance, "El Perro con la Nariz Fria" might be a literal translation of the title of his July article "The Cold-Nosed Hound," but it certainly would be far from the detective angle the author was implying.

Steel Balls Worth Their Weight in Gold

Steel balls 1 millimeter in diameter are being produced by S K F Industries, Inc., for ballpoint pens. They sell roundly for $35 an ounce (price of gold in Uncle Sam's emporium), about 7000 to the ounce. Weigh out a pound for the gentleman—he's a step-lively subway guard whose job is to keep crowds moving.

Conventions Unlimited

The summer hiatus always acts as a springboard for the metal-working industries to jump into a series of fall conventions and meetings. To wit: American Society of Mechanical Engineers started the drumbeating in Erie, Pa., on September 28; the call to convene was next trumpeted in the West as the American Society for Testing Materials plans its meeting in San Francisco on October 10; gathering momentum, National Metal Congress arranges its meeting on October 17 in Cleveland, American Gear Manufacturers' Association on October 24 in Chicago, and American Society of Tool Engineers on October 27 in Montreal —a whirlpool month for the circulation of ideas.

Belgian Bond

From Belgium, the Fabrique Nationale d'Armes de Guerre wrote for information on Tygon, an air dry rack coating described in MACHINERY. We passed the request on to its manufacturer, the United States Stoneware Co. The right man there answered Fabrique Nationale: "The writer [Stanley C. Powers] had the pleasure of visiting your plant in Herstal-Liege during the last war. Our unit was stationed in Liege for a short period of time. The people of Liege were most kind to us, and we certainly were appreciative."

DIOGENES WITH A TOOL—Contributor August W. Jansson is retired in fact but active in effect, as you may see by referring to his June article "Cone Pulley with High-Ratio Epicyclic Reduction Gearing." Born in Sweden in 1878 of a people who had spent their lives at Gimo Bruk, an iron works situated on a baronial estate that provided homes, food, and medical care for its employes, he came to America alone in 1903, in his possession the diploma of the Tekniska Skolan of Stockholm. Then followed associations as a tool designer with many prominent machine tool companies in the East, two trips back to Sweden, U. S. citizenship, and a period of twenty-four years

as master mechanic at the Lamson & Sessions Co., Cleveland. Buying a home in Orrville, Ohio, Mr. Jansson retired at the age of sixty-three, but during the war period returned to industry, designing tools, machinery, and methods at the Will-Burt Co. He is a life member of the Cleveland Engineering Society. Again at leisure, Mr. Jansson studies philosophy, as he has always done, and nostalgically thinking of the miniature steam engines he built as a boy in Sweden, contemplates building a model of the James Watt "Walking Beam" steam engine. Mr. Jansson says "A clean mouth and an honest hand will take a man through any land."

News of the Industry

Arkansas and Texas

SOUTHERN EXTRUSIONS, INC., North Washington St., Magnolia, Ark., is a new concern organized by R. W. SULLIVAN, H. N. SEBRING, and J. A. IDA, all of whom have been engaged in the aluminum field of extrusion for many years. The company occupies a new plant containing 45,000 square feet of floor space, and has been in production for several months extruding aluminum shapes, rods, and bars.

DOLAN INDUSTRIAL SALES, 318 Union National Bank Bldg., Houston 2, Tex., has been appointed representative in southern Texas for the COLONIAL BROACH CO., Detroit, Mich., manufacturer of broaching machines, broaches, and broach sharpening equipment. The Dolan company will also represent COLONIAL BUSHINGS, INC., of Detroit, manufacturer of drill jig bushings and liners.

Connecticut and Massachusetts

CONNECTICUT MECHANICAL INDUSTRIES, INC., 390 Capitol Ave., Hartford, Conn., has recently been organized to engage in the tool, die, and contract machine shop fields. The new corporation was formed by seven Connecticut tool, die, and contract manufacturing shops with assets of more than one million dollars. It has facilities that include over 90,000 square feet of floor space, 625 machine tools and other accessory equipment, and several hundred skilled craftsmen. The officers are: President, JOHN H. DOWD, president of the Johns-Hartford Tool Co.; vice-president, HERMAN FINK, president of the Cooperative Tool & Machine Co.; and treasurer, CHARLES NEUMANN, president of the Argus Engineering Co.

WHITON MACHINE CO., New London, Conn., manufacturer of lathe chucks, centering machines, special-purpose milling machines, and gear-cutting machines, announces the opening of a Chicago office at 310 S. Michigan Ave., with VINCENT T. PETERSON in charge as factory representative. The company also announces the appointment of the following new representatives: SCREW MACHINE TOOL & SUPPLY CO., 2400 W. Clybourn St., Milwaukee 3, Wis.; PACIFIC COAST TOOL CO., 1711 Webster St., Oakland 12, Calif; and the WOODALL ENGINEERING & SALES CO., Dayton, Ohio.

JAMES L. BYROM was elected a vice-president of the Niles-Bement-Pond Co., West Hartford, Conn., at a recent board of directors' meeting. Mr. Byrom is manager of the Chandler-Evans Division of the company, manufacturer of aircraft-engine accessories.

JOHN G. BENJAMIN has been made sales manager of the Abbott Ball Co., Hartford, Conn., succeeding J. M. TAYLOR, who has resigned.

CARLYLE JOHNSON MACHINE CO., Manchester, Conn., manufacturer of the "Maxitorq" clutch, has appointed BOURKE & MABEE, Harbour Commission Bldg., Toronto 1, Ontario, Canada, as sales representative.

A. H. LOUX has been appointed manager of distributor sales for the Flexible Tubing Corporation, Branford, Conn., maker of "Spiratube" flexible tubing.

WILLIAM C. HOWARD, JR., and WALTER E. FOREMAN have been appointed field engineers by the Norton Co., Worcester, Mass., manufacturer of abrasive products and grinding machinery. Mr. Howard's headquarters will be in Hartford, Conn., and Mr. Foreman's in Cleveland, Ohio.

RESEARCH ENGINEERING & MFG. CO. has been organized at New Bedford, Mass. Its activities will include patent investigations to determine the feasibility of manufacture of the patented articles; purchase of valid patents; and manufacture of patented articles on a royalty basis.

ELLIOTT C. PADDOCK has been appointed to the newly created position of vice-president in charge of sales of the Graton & Knight Co., Worcester, Mass.

District of Columbia and Maryland

WILLIAM E. SUMMERBELL CO., DuPont Circle Bldg., Washington, D. C., has been appointed representative for the LOGANSPORT MACHINE CO., INC., Logansport, Ind., manufacturer of air- and hydraulic-operated equipment.

EARL ROBERTS has been appointed a sales engineer with the Memphis, Tenn., branch of the Black & Decker Mfg. Co., Towson 4, Md. He was previously with the service department at Memphis.

Illinois and Indiana

AZED, INC., 80 E. Jackson Blvd., Chicago 4, Ill., has recently been organized by POOR & CO., of Chicago, and the ACME STEEL CO., Riverdale, Ill., to engage in the research, manufacture, and sale of products and processes for the application and secondary treatment of zinc surfaces. The company will serve zinc electroplaters, hot-dip galvanizers, and zinc-base die-casting manufacturers and finishers. The president of the new corporation is F. A. POOR, chairman of the board of Poor & Co.

MID-STATES WELDER MFG. CO., Chicago, Ill., has been formed to take over the manufacture of the lines of welding equipment formerly produced by the MID-STATES EQUIPMENT CORPORATION. All production equipment and the general offices of the company have been moved to a large plant recently purchased at 6025 S. Ashland Ave.

BORG-WARNER CORPORATION, Chicago, Ill., has sold its Superior Sheet Steel Division plant near Canton, Ohio, to the LOUIS BERKMAN CO., of Steubenville, Ohio.

GEORGE A. POCKELS has been appointed director of European operations for the Clearing Machine Corporation, Chicago, Ill., manufacturer of presses. He will make his headquarters in Paris, France.

George A. Pockels, director of European operations for the Clearing Machine Corporation

Want to cut costs on parts like these?

Broaching has cut costs on every one of these parts, as on many hundreds of others, reducing floor-to-floor time, cutting idle time of machines and operators for tool changes, improving accuracy and maintaining it. It's really remarkable how little time Colonial broaching equipment takes to pay for itself.

PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

Have a Colonial Representative check over your parts for ways and means to cut costs by broaching. Write or wire now, before you forget it.

JIM HOLLAND, for twelve years sales manager of the Phillips Division of the American Screw Co., has been appointed sales manager of the Camcar Screw & Mfg. Corporation, Rockford, Ill. The latter corporation recently changed its name from CAMCAR PRODUCTS CO. to the CAMCAR SCREW & MFG. CORPORATION.

PERFECTION GEAR CO., Harvey, Ill., has purchased the AMERICAN STOCK GEAR CO., of Chicago, and will move the business to the company's plant at 152nd St. and Vincennes Ave., in Harvey. The newly acquired company will be operated as the AMERICAN STOCK GEAR DIVISION OF PERFECTION GEAR CO.

JOHN F. MILLER has been appointed manager of the Tool Division of the Illinois Tool Works, Chicago, Ill. He was previously sales manager of the machine tool and cutting tool division of the Ex-Cell-O Corporation, Detroit, Mich.

FRANK M. MASON, JR., has been appointed director of engineering of Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill. For several years, he has been manager of the Research Division.

W. K. MILLHOLLAND MACHINERY CO., Indianapolis, Ind., has recently moved its offices from 1048 Fairfield St. to the company's plant at 6402 Westfield Blvd.

Michigan and Minnesota

WROUGHT MAGNESIUM CORPORATION has recently been incorporated as a subsidiary of Brooks & Perkins, Inc., Detroit, Mich., fabricators of magnesium for aircraft, radar, electronic and other equipment. Plans have been made for the erection of a 40,000 square foot building in the Detroit area which will be used for the production of sheet and plate magnesium. The plant is expected to be completed and in production within a year. The officers of the new concern are HOWARD PERKINS, president; K. C. REEVES, vice-president and treasurer; and F. W. SEITZ, secretary. Company offices have been established at 2457 Woodward Ave., Detroit 1, Mich.

TOMKINS-JOHNSON CO., Jackson, Mich., recently held a sales conference at the company's plant, which was attended by thirty-eight sales representatives. The salesmen were given a preview of the new line of air cylinders and the improved "Clinchor" for setting clinch nuts, which will be displayed, together with the company's line of hydraulic cylinders, cutters, "Rivitors," and air controls, at the coming National Metal Exposition in Cleveland.

PAUL F. ZERKLE, sales manager of the Michigan Tool Co., Detroit, Mich., is spending two months visiting industrial plants in England, France, western Germany, Sweden, Holland, and Italy, for the purpose of assisting foreign industries with their gear production problems.

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass., announces that it has opened a warehouse at 447 W. Congress St., Detroit 26, Mich., to expedite service and delivery to users of Morse cutting tools in that area.

E. W. BLISS CO., Toledo, Ohio, announces the removal of its Detroit district sales office to the Fisher Bldg., Room 2214.

A. A. GUSTAFSON, 2580 University Blvd., St. Paul W4., Minn., has been appointed factory representative for Scully-Jones & Co., Chicago, Ill.

New York and New Jersey

WALTER H. WIEWEL has been appointed vice-president in charge of sales of the Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y. Mr. Wiewel, who retains his present post as president of the Crucible subsidiary, Trent Tube Co., East Troy, Wis., was also elected a member of the Crucible board of directors. Announcement has also been made that R. S. POISTER, a vice-president and director of the company, is now in charge of all manufacturing operations. M. E. CUMMINGS, assistant to the president since 1945, has been made assistant vice-president in the operations department. WILLIAM E. PENNINGTON, formerly assistant general manager of sales, becomes eastern sales manager, with headquarters in New York, and JOHN S. BILLINGSLEY, Pittsburgh branch manager, has been made central sales manager, retaining his headquarters at Pittsburgh.

Walter H. Wiewel, new vice-president in charge of sales for the Crucible Steel Co. of America

JOSEPH H. PARSONS, assistant vice-president of the Brake Shoe and Castings Division of the American Brake Shoe Co., New York City, has been appointed vice-president in charge of miscellaneous castings sales. ROBERT B. POGUE, chief engineer for the division since 1937, has been made vice-president in charge of engineering, and ROSSER L. WILSON, formerly assistant chief engineer, has been promoted to the position of chief engineer vacated by Mr. Pogue.

ISHAM KEITH has been appointed machinery manager of the New York office of Pratt & Whitney Division Niles-Bement-Pond Co., succeeding HAROLD F. WELCH, who recently resigned after serving as manager of this office since 1925. Mr. Keith has been with the organization for twenty years, doing sales engineering work in the New York territory, as well as in the Rochester and Milwaukee districts.

CHICAGO PNEUMATIC TOOL CO. is building a $5,000,000 plant in Utica, N. Y. The main building is over one-fifth of a mile long and nearly half as wide. The latest equipment has been installed for producing the company's line of pneumatic tools, and production lines have been designed to speed up the output of these tools. The plant includes a forge shop, plating shop, power plant, and foundry.

OSCAR C. STARK has been appointed general sales manager of Photoswitch, Inc., Cambridge, Mass., manufacturer of photoelectric and electronic controls. He will make his headquarters at the factory sales office, 39 Broadway, New York City. Mr. Stark had been connected since 1930 with the Square D Co. in various sales and management capacities.

HAUSER MACHINE TOOL CORPORATION, Manhasset, N. Y., has been appointed factory representative in the United States for TORNOS WORKS, LTD., Moutier, Switzerland, manufacturer of the "Swiss" type automatic screw machine, cam-making equipment, and precision wood-screw machines.

R. E. BURROUGHS has been made manager of engineering of the Aircraft Gas Turbine Division of the General Electric Co., Schenectady, N. Y., succeeding H. D. KELSEY, who has been appointed administrative assistant to the manager of the turbine divisions.

FRANK J. ASCHENBRENNER and EARL C. CLARK have been appointed assist-

ant director of research and engineering for the Air Reduction Sales Co., New York 17, N. Y. J. K. HAMILTON has been made manager of the Apparatus Research Division, and H. O. KLINKE, assistant manager. The research laboratory of the company is at Murray Hill, N. J., where all these men will be located.

FRANK W. BLANCHETTE has been appointed representative of the Sheffield Corporation and its subsidiary, the Murchey Machine & Tool Co., for New York City and a large portion of New Jersey. His office is located at 965 Broad St., Newark, N. J.

Frank W. Blanchette, New York representative of Sheffield Corpn. and Murchey Machine & Tool Co.

Ohio

JOSEPH B. CLOUGH has joined Godfrey Tool & Supply, Inc., 10012 Carnegie Ave., Cleveland 6, Ohio., distributor of cutting tools and special industrial products, in the capacity of vice-president. Mr. Clough was formerly associated with the A. W. Hecker Co. as assistant to the president.

GEOMETRIC TOOL CO., New Haven, Conn., manufacturer of machinery and tools for cutting screw threads, has appointed the GEORGE WORTHINGTON Co., 802 St. Clair, N. W., Cleveland 13, Ohio, distributor for Cleveland and vicinity, replacing the JEFFERY-GILLES Co., which is no longer in business.

TINNERMAN PRODUCTS, INC., Cleveland, Ohio, has made plans to erect a $1,500,000 plant on Brookpark Road in Brooklyn Village (Cleveland) to meet the increasing demands for the company's line of "Speed Nut" fasteners.

James E. Brown, assistant general superintendent, Cuyahoga Works, American Steel & Wire Co.

JAMES E. BROWN has been appointed to the newly created position of assistant general superintendent of the American Steel & Wire Co.'s Cuyahoga Works (Cleveland). Mr. Brown was formerly on the staff of the vice-president in charge of operations.

GEORGE M. LANGE has been appointed regional sales manager in the Mid-West area for the Tyson Bearing Corporation, Massillon, Ohio. Immediately prior to his present appointment, Mr. Lange was a project engineer of the Ex-Cell-O Corporation of Detroit, Mich.

GEORGE PERRAULT, JR., has been made sales manager of the Rolling Mill Division of the E. W. Bliss Co. at Salem, Ohio. He was previously sales and advertising manager of the Salem Engineering Co.

RESISTANCE WELDING INSTITUTE announces the removal of its headquarters to the Hartman Bldg., Warren Road at Detroit Ave., Cleveland, Ohio.

Pennsylvania

HENDLEY BLACKMON has been appointed assistant manager of engineering association activities for the Westinghouse Electric Corporation, with headquarters at the East Pittsburgh Works. Mr. Blackmon had formerly been manager of the corporation's Technical Press Bureau, but resigned in 1945 to join the McGraw-Hill Publishing Co. He was managing editor of *Electrical World* prior to his return to Westinghouse.

A. C. RUNNETTE has been named manager of the sand and permanent-mold casting product sales for the Aluminum Co. of America, Pittsburgh, Pa. He succeeds WISER BROWN, who is vice-president and general manager of the American Magnesium Corporation — an Alcoa subsidiary—and who plans to devote his full time in the future to magnesium products.

WILL L. CORBETT has been appointed to the newly created post of assistant to the district manager of the American Steel & Wire Co., Pittsburgh, Pa. He was formerly superintendent of industrial relations at the Waukegan, Ill., plant of the company. L. F. MCGLINCY has been made district manager of operations in Pittsburgh.

HENRY N. MULLER, JR., manager of the educational department of the Westinghouse Electric Corporation, Pittsburgh, Pa., has been made assistant to the vice-president in charge of engineering. In addition to his new engineering duties, Mr. Muller will continue to direct the educational department.

EMERSON D. OGLE has been appointed manager of the industrial sales department of S K F Industries, Inc., Philadelphia, Pa., succeeding C. D. CUMMINGS, who has resigned. Prior to his promotion, Mr. Ogle was manager of the automotive and electrical section of the industrial department.

J. C. FINK, formerly manager of the Industry Engineering Department of the Westinghouse Electric Corporation, Pittsburgh, Pa., has been made assistant to A. C. MONTEITH, vice-president in charge of engineering. Mr. Fink has been with the company since 1927.

LANDIS TOOL CO., Waynesboro, Pa., manufacturer of precision cylindrical grinders, has appointed the following new distributors: C. F. BULOTTI Co., 475 Fourth St., San Francisco, Calif., and the LANG Co., Box 479, Salt Lake City, Utah.

JOHN H. BIGGS, Rochester representative for the Brown & Sharpe Mfg. Co., Providence, R. I., has been transferred to the Philadelphia office, succeeding THOMAS F. MACLAREN, who will assume other responsibilities for the company.

JOHN H. FAUNCE, JR., district manager of sales at the Chicago office of the Lukens Steel Co., Coatesville, Pa., for the last three years, has been appointed manager of sales promotion, with headquarters at Coatesville.

JOHN T. RAMSDEN, chief engineer of the Tabor Mfg. Co., Philadelphia, Pa., manufacturer of foundry equipment, has retired after forty-eight years of service with the company.

A. P. SCHMAUCH has been named manager of industrial engineering for the Rockwell Mfg. Co., Pittsburgh, Pa.

W. S. EHRENFELD Co., 531 W. King St., York, Pa., has been appointed distributor by the CARBOLOY COMPANY, INC., Detroit, Mich.

Coming Events

OCTOBER 10-14 — National meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS in San Francisco, Calif.; headquarters, Fairmont Hotel. Headquarters of the Society, 1916 Race St., Philadelphia 3, Pa.

OCTOBER 17-21 — NATIONAL METAL CONGRESS and EXPOSITION to be held in connection with the thirty-first annual meeting of the AMERICAN SOCIETY FOR METALS at the Public Auditorium in Cleveland, Ohio. National secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 17-21—Fall meeting of the METALS BRANCH, AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, in Cleveland, Ohio. Secretary, E. H. Robie, 29 W. 39th St., New York 18, N. Y.

OCTOBER 17-21—Annual meeting of the AMERICAN WELDING SOCIETY in Cleveland, Ohio. Executive secretary, Joseph G. Magrath, 33 W. 39th St., New York 18, N. Y.

OCTOBER 17-21—Midwest meeting of the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS in Cincinnati, Ohio. For further information, address the Society at its headquarters, 29 W. 39th St., New York 18, N. Y.

OCTOBER 24-26—Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel in Chicago, Ill. Executive secretary, Newbold C. Goin, Empire Bldg., Pittsburgh 22, Pa.

OCTOBER 24-28—Thirty-seventh NATIONAL SAFETY CONGRESS and EXPOSITION in Chicago, Ill. R. L. Forney, general secretary. National Safety Council, 201 N. Wacker Drive, Chicago 6.

OCTOBER 26-28—Fiftieth annual convention of the NATIONAL METAL TRADES ASSOCIATION at the Palmer House, Chicago, Ill. Further information can be obtained from the headquarters of the Association, 60 E. 42nd St., New York 17, N. Y.

OCTOBER 27-29—Seventeenth semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Mount Royal Hotel, Montreal, Canada. Executive secretary, H. E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

NOVEMBER 1-5 — PACIFIC CHEMICAL EXPOSITION and PACIFIC INDUSTRIAL CONFERENCES at the San Francisco Civic Auditorium, San Francisco, Calif. Chairman of California Section, American Chemical Society, Dr. Richard Wistar, Hotel Whitcomb, San Francisco 1, Calif.

NOVEMBER 28-DECEMBER 2—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Statler, New York City. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

NOVEMBER 30-DECEMBER 2—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel New Yorker, New York City. For further information, address the Society, Box 168, Cambridge 39, Mass.

JANUARY 16-19, 1950—First Plant Maintenance Show in the Auditorium, Cleveland, Ohio. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MARCH 28-31, 1950 — FOURTH NATIONAL PLASTICS EXPOSITION at the Navy Pier, Chicago, Ill. Sponsored by the SOCIETY OF THE PLASTICS INDUSTRY. William T. Cruse, executive vice-president, 295 Madison Ave., New York 17, N. Y.

APRIL 10-14, 1950—Exposition of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Convention Hall and Commercial Museum in Philadelphia, Pa. Details available upon request to the Exposition headquarters, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

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Annual Index to MACHINERY

The annual index to Volume 55 of MACHINERY (September, 1948, to August, 1949, inclusive) is now ready for distribution. Subscribers who have not previously requested copies can obtain them without charge by writing to MACHINERY, Circulation Department, 148 Lafayette St., New York 13, N. Y.

* * *

There are 14,500 pounds of steel in use for every man, woman, and child in the United States.

Alexander H. d'Arcambal, vice-president and sales manager, Small Tool and Gage Division, and consulting metallurgist of Pratt & Whitney Division, Niles-Bement-Pond Co., who recently observed the thirtieth anniversary of his association with the company. Joining Pratt & Whitney as chief metallurgist in 1919, Mr. d'Arcambal directed the program of the company in metallurgical developments applying to machine tools, cutting tools, and gages. He also directed all of the metallurgical work pertaining to the P & W aircraft engine during the development of that product. In 1945, Mr. d'Arcambal went to Europe as a member of the "Metallurgical Mission to Germany" to inspect processing used by the Germans in their cutting tool and gage plants.

Left—5 of the 55 pieces of luggage in the smart Samsonite line. All are now equipped with lustrous, solid brass fittings to make Samsonite Luggage look better longer.

Samsonite Luggage

SWITCHES TO SOLID BRASS FITTINGS . . . TO MAKE THE "WEAR SPOTS" ON ITS LUGGAGE STAY SMARTER LOOKING LONGER.

Revere Brass Strip selected for its unusually fine, uniform grain after hardware is formed.

● The name Samsonite has become synonymous with quality luggage the country over. It has a reputation to uphold. For that reason, when the brass plated fittings with which this luggage was initially equipped, started to tarnish and show signs of premature wear, the Samsonite people did a double-take. After consulting with their own engineers and the Revere Technical Advisory Service it was decided that nothing less than solid brass would be in keeping with so fine a line of luggage. Revere Brass Strip, because of its very fine uniform grain, was selected for the job.

Samsonite was extremely pleased with the results. They found that after the luggage hardware was formed it had just the lasting, lustrous quality they were looking for. A fitting companion for the smart Samsonite cases. Now, all external hardware and the internal fittings, where rusting would be detrimental, are of solid brass. Even the keys, usually stamped, are of solid brass, coined and milled.

Perhaps Revere Brass or some other Revere Metal can be of help in improving your product—cutting your production costs. Why not tell Revere's Technical Advisory Service about *your* metal problems? Call the Revere Sales Office nearest you today.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

New Books and Publications

METAL-CUTTING TOOL HANDBOOK. 647 pages, 6 by 9 inches. Published by the Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price, $6.50.

This is the first handbook devoted exclusively to metal-cutting tools and their use. It contains complete information on the various types of metal-cutting tools, their operation and maintenance. There are sections on twist drills, reamers, counterbores, taps, dies, milling cutters, hobs, gear-shaper cutters, and broaches, each containing data on speeds, feeds, operating conditions, and sharpening and maintenance instructions. Tables of commercial sizes of each type of tool are included. The book concludes with a section giving engineering data and tables commonly used by those engaged in the cutting of metals, such as hardness conversion tables; tables of gear-tooth parts; spline-shaft tables; involute spline tables; trigonometric function tables, etc. The material was compiled by a committee of engineers who gathered the data from manufacturers of metal-cutting tools and added original information.

S A E HANDBOOK (1949). 933 pages, 5 3/4 by 8 inches. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York 18, N. Y. Price to non-members, $10.

Thirty-one new automotive standards and specifications are presented in this edition of the S A E Handbook. The annual publication has undergone the most extensive series of revisions in its thirty-nine years, affecting ninety-two standards and specifications; nine standards have been cancelled.

An important contribution to this edition of the book is in the field of steel and non-ferrous and other materials specifications. The new specifications include corrosion- and heat-resistant alloy steel castings, tool and die steels, and surface finish. Standardized for the first time is a series of alloy steels known as H-steels, which can be brought to hardenability specifications.

DYNAMIC EQUIPMENT POLICY. By George Terborgh. 290 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $3.75.

Equipment policy is the most backward area of industrial management, according to the author of this book, who is research director of the Machinery and Allied Products Institute. Not only do many companies lack effective organization for bringing profitable re-equipment opportunities to the attention of the management, but in most cases the executives responsible for buying equipment have no adequate technique for analyzing the merits of the proposals submitted. To help meet such an important management need, this book outlines the basic principles of sound re-equipment analysis and discusses practical procedures for their application. Numerous examples taken from actual experience are used to illustrate the procedures. It describes functional degradation of capital equipment with age and use, and its displacement by superior equipment, illustrating the process by statistical examples. It clearly analyzes various replacement problems, and presents a replacement formula developed by the author over many years of study and collaboration with executives in the capital goods industries.

WELDING METALLURGY. By O. H. Henry and G. E. Claussen (Revised by G. E. Linnert). 505 pages, 5 1/4 by 7 3/4 inches. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $2.50.

This is the second edition of a book originally published in 1940 which has been thoroughly revised and brought up to date to include data on processes that have been introduced during the last eight years, such as inert-gas metal-arc welding, as well as information on the metallurgy of such materials as stainless, heat-resistant, and stainless-clad steels. A short bibliography has been added at the end of each chapter to give sources of additional information on the subject covered, and questions are provided at the end of the book for use in schools or other home study. The opening chapters outline the fundamentals of metallurgy, after which the welding metallurgy of specific materials and the effect of different elements are discussed.

WELDING AND CUTTING MANUAL. 208 pages, 6 by 9 inches. Published by The Linde Air Products Co., Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. Price, $1.80.

Those engaged in welding and cutting by the oxy-acetylene process will find helpful information in this new handbook. While written especially for the repairman, garage mechanic, and maintenance man, there is much material that will help any welding operator do a better job. Definite instructions are given for bronze welding; fusion welding; soldering; hard-facing; cutting steel and cast iron; heating, forming, and straightening of metals; welding and cutting pipe; and welding non-ferrous metals. The appendix contains useful charts and tables, a glossary of welding terms, and a list of one hundred repair jobs with recommended welding methods.

STEEL AND ITS HEAT-TREATMENT. (Vol. III—Engineering and Special-Purpose Steels). By D. K. Bullens and the Metallurgical Staff of the Battelle Memorial Institute. 606 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.50.

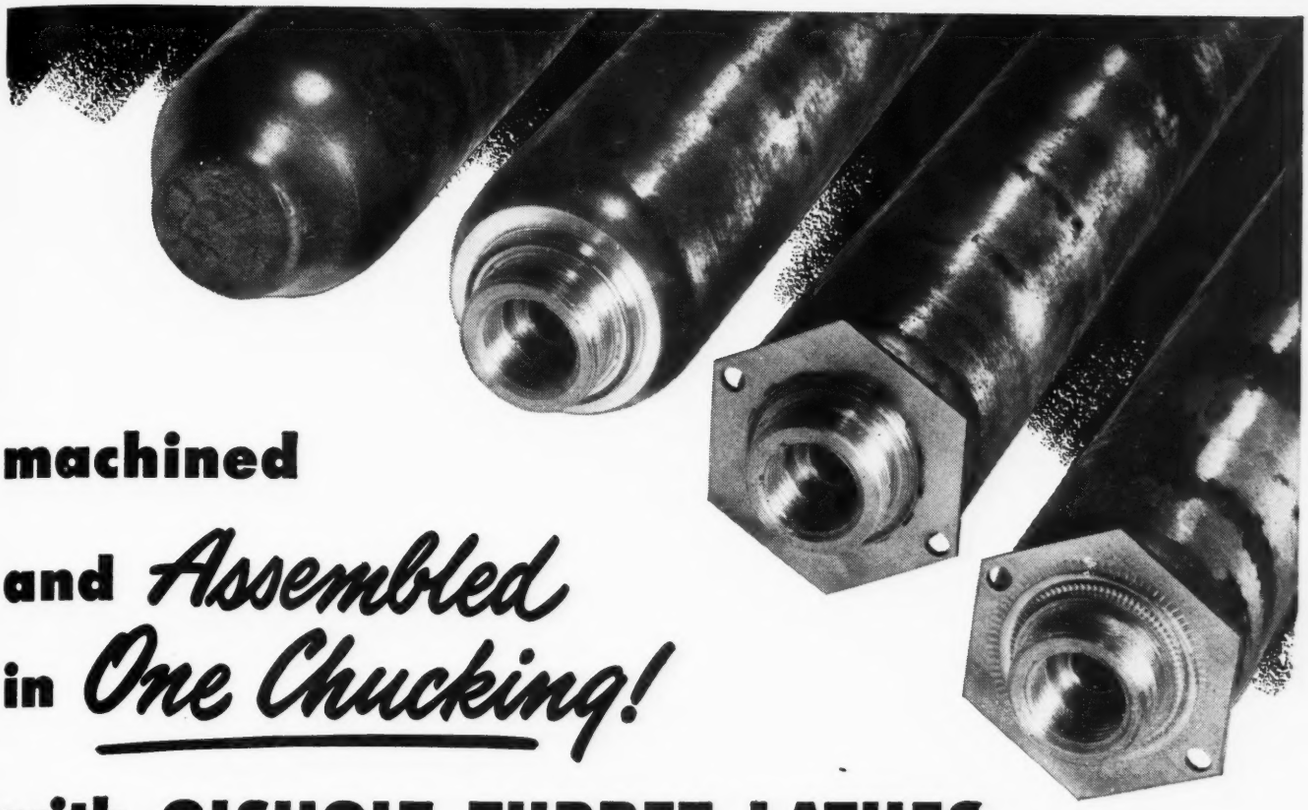
Complete data on the more important alloy or special steels and their heat-treatment are presented in this work, of which this is the fifth edition. The effects of heat-treatment on the suitability of these steels for various uses are analyzed, as are the possibilities of utilizing alternate steels. The material is divided into three sections, treating, respectively, of engineering alloy steels, constructional alloy steels for heat-treating, and special steels. Volumes I and II of this work deal, respectively, with the principles relating to the heat-treatment of steel in general, and the tools, processes, and control used in application.

OXY-ACETYLENE WELDING AND CUTTING. By Stuart Plumley. (Revised and re-written by T. B. Jefferson.) 356 pages, 8 by 11 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, New York. Price, $6.50.

This book, which is now in its fourth edition, was written to meet the need for a concise, easy-to-understand course of instruction in oxy-acetylene welding and cutting technique. It begins with basic principles, and proceeds, step by step, to show how skill is developed in handling both repair and production work. Changes devised in the use of the oxy-acetylene flame are explained. The book covers all types of welding and cutting work—pipe-line welding, flame-cutting of steel and cast iron, brazing, lead welding, welding of light metals, bronze welding and brazing, hard-facing, and boiler and firebox welding.

CONSTRUCTIVE USES OF ATOMIC ENERGY. Edited by S. C. Rothmann. 258 pages, 5 1/2 by 8 inches. Published by Harper & Bros., 49 E. 33rd St., New York 16, N. Y. Price, $3.

Everyone is aware of the frightful potentialities of atomic energy for destruction, but few are informed of the constructive uses of this amazing new force. This is the first book to



machined and *Assembled* in *One Chucking!* with GISHOLT TURRET LATHES

Talk about clever ideas! Here's one used by the Ansul Chemical Company, manufacturer of dry chemical fire extinguishers, to cut time, cut costs and do a better job.

Eight different operations on these gas pressure cartridges are performed on a Gisholt No. 5 Ram Type Turret Lathe as follows: Turn, face, bore, thread, tap, attach splined collar, groove collar, and roll edge. And all in one chucking!

Combining all these operations on a Gisholt Turret Lathe eliminates another handling and welding operation—saves from 30% to 40% of former time. What's more, it has resulted in more uniform work and better appearance.

It's another example of using ingenuity to save money. Gisholt engineers are ready to give you the best of their experience—to help cut *your* time and costs. Write us.

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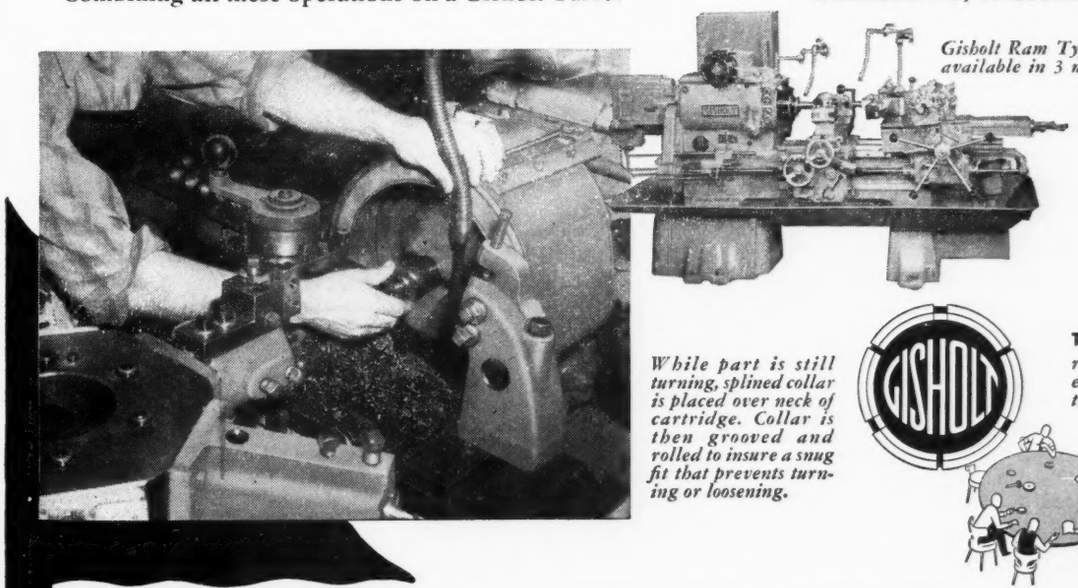

Gisholt Ram Type Turret Lathes are available in 3 models with standard chuck sizes ranging from 8" to 15".

While part is still turning, splined collar is placed over neck of cartridge. Collar is then grooved and rolled to insure a snug fit that prevents turning or loosening.

GISHOLT

The Gisholt Round Table *represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

describe for the layman the "peaceful atom" and the uses to which it is being put at the present time in such fields as industrial power, chemistry, metallurgy, aviation, ceramics, soil-fertilizer research, and biological, pharmaceutical, and medical research. The book contains a collection of fourteen articles by scientists who are among the leaders in atomic research, written in easily understandable form.

MATHEMATICS FOR INDUSTRY. By S. E. Rusinoff. 519 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. Price, $5.50.

Emphasis is laid in this book on the mathematics required in the engineering shop, drafting-room, toolroom, and inspection departments. All of the examples given are applied to shop problems frequently encountered. There are seven chapters that review the principles of arithmetic, algebra, geometry, and trigonometry, and apply these principles to shop and tool-room problems. The following chapters cover screw threads, gears, logarithms, the slide-rule, and engineering computations.

PLASTICS INSPECTION. 112 pages. Published by the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C. Price, $2.75.

The nature of plastics materials, their methods of fabrication, properties, and tests are covered in this manual, which was originally prepared by the Air Force in 1945 to assist Government inspectors in examining aircraft parts. About 150 photographs, drawings, and charts illustrate the general principles and specific applications of plastics. The booklet is intended to serve as a text for students or for use in training courses.

UNIFIED SCREW THREAD STANDARDS. 27 pages, 8 by 10 inches. Published as Circular 479 of the National Bureau of Standards, U. S. Department of Commerce. Sold by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 20 cents per copy.

This book contains the proceedings of the meeting at which an accord for the unification of American, British, and Canadian standard systems of screw threads was signed, together with detailed illustrations, tables, and numerical data covering the new unified screw thread standards.

DIAMOND TOOL PATENTS. By P. Grodzinski and W. Jacobsohn. 55 pages, 7 by 9 3/4 inches. Published by the Industrial Diamond Information Bureau, 32-34 Holborn Viaduct, London, E C.1, England. Price, 10 shillings.

The second edition of this survey of patents on diamond tools for machining metals and non-metallic substances covers 200 patent specifications. An appendix has been added on machines and equipment for shaping industrial diamonds, which includes twenty specifications.

AMERICAN STANDARD LETTER SYMBOLS FOR GEAR ENGINEERING (Revised Edition). Prepared by the Sectional Committee on Standardization of Gears, sponsored by the American Gear Manufacturers Association and the American Society of Mechanical Engineers. Obtainable through the American Standards Association, 70 E. 45th St., New York 17, N. Y., or the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, 30 cents.

UNIFIED AND AMERICAN EXTERNAL SCREW THREADS. 34 pages, 8 1/2 by 11 inches. Published by the Reed Rolled Thread Die Co., 237 Chandler St., Worcester 2, Mass. Price, 75 cents.

This pamphlet contains graphical illustrations of thread components, definitions, and tables of the new standard thread Classes 1A, 2A, 3A, 2, and 3. Tables include limits, tolerances, and allowances of the standard and selected special threads.

PROGRESS REPORTS OF INVESTIGATION OF RAILROAD RAILS AND JOINT BARS. By R. E. Cramer and R. S. Jensen. 35 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 39 of the Engineering Experiment Station. Price, 15 cents.

FLEXURAL FATIGUE STRENGTH OF STEEL BEAMS. By Wilbur M. Wilson. 34 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 377 of the Engineering Experiment Station. Price, 20 cents.

* * *

Westinghouse Announces Motor Exchange Plan

The Westinghouse Electric Corporation has announced a plan for prompt exchange of motors in the event of failure, so as to minimize the loss of productive time. For this purpose, stocks of replacement motors are maintained at Westinghouse warehouses throughout the country. The plan is applicable to single-phase and three-phase alternating-current motors of from 1 to 20 H.P., with frame numbers from 203 to 326.

Obituaries

Arthur E. Ulrich

Arthur E. Ulrich, sales executive of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., died suddenly on September 8 while on a business trip to Toledo, Ohio. Mr. Ulrich was born in Brunnen, Switzerland on February 16, 1891. After graduating from the Technical University at Mitwaida, Germany with degrees in mechanical and electrical engineering, he came to the United States in 1913, and became an American citizen in 1928.

From 1916 to 1922, Mr. Ulrich was connected with Joseph T. Ryerson & Son, of Chicago, and it was during this period that he was associated with the late H. B. Kraut, former chairman of the board of the Giddings & Lewis Machine Tool Co., who was then manager of the Ryerson Machinery Division. In 1925, he joined the Giddings & Lewis Machine Tool Co., and was district sales manager for the company in Detroit and the middle eastern states for twenty-one years. He is survived by his widow and two daughters.

JAMES W. CHALMERS, for twenty-five years associated with the William K. Stamets Co., Pittsburgh, Pa., in the capacity of sales engineer, died on September 1. He was a member of the American Society of Tool Engineers and had served on the War Production Board in Washington during World War II.

* * *

For every ton of hot metal made in a blast furnace, about 4 1/2 tons of air are required. The solid raw materials entering the furnace add up to 3 1/4 tons for each ton of hot metal produced.